Do the Poor Pay More?
An Empirical Investigation of Price Dispersion in Food Retailing

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Abstract

There is a longstanding question of whether the poor face positive price differentials for food. The prior research in this area is decidedly mixed. This paper revisits the issue of pricing structures by analyzing unpublished price-level data collected by the Bureau of Labor Statistics to answer the question of whether prices are higher in poor, urban neighborhoods. Using this large, statistically representative sample of stores in poor and affluent neighborhoods, I empirically test the major arguments in support of disparate prices such as differences in quality, operating and consumer search costs, and price discrimination by storeowners. I also explore the relationship between pricing strategies and the racial and ethnic composition of poor neighborhoods. I find that market prices are up to 6 percent less in poor neighborhoods after controlling for a variety of covariates. In addition, I find that poor, predominantly white and Hispanic neighborhoods experience significant discounts, while market prices in poor, predominantly black neighborhoods are comparable to those in affluent white areas.

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I. Introduction

At the center of many inner-city business-rebuilding initiatives lies the premise that inner-city consumers are subjected to higher prices for lower quality goods. For example, this premise underlies the current debate in major cities such as New York, Chicago, and Los Angeles over the construction of "super" food stores (stores with more than 30,000 square feet of retail space) in urban areas. Proponents of the large establishments posit that low-income residents pay significantly more than other income groups for necessities while receiving lower quality and less variety. They contend that market prices are higher in poor neighborhoods because residents are limited to shop at smaller, independent stores and retailers at such establishments discriminate against the poor by exploiting their limited mobility [Mitchell 1992]. Such exploitation can be modeled as classical price discrimination, in which retailers extract consumer surplus through the segmentation of the market [Pigou 1920]. Price discrimination exists if (and only if) the same variety of a commodity is sold to two different buyers at different net prices [Phlips 1983]. In order for price discrimination to be a viable strategy, a retailer must have market power, a means to segment the market, and the ability to prevent resale.[1] Other proponents of superstores contend that the market price differential between poor and affluent neighborhoods is due to "non-economic," or racial, discrimination. This view can be modeled as Becker's [1957] taste for discrimination in which the poor are charged more to compensate retailers for racial or class preferences.[2]

[1] The first condition is no longer interpreted in the strong sense of absolute monopoly power (see e.g., Greenhut and Greenhut [1975] and Norman [1981]). Duopolists, oligopolists, and small competitors in differentiated markets can practice price discrimination. Price discrimination by inner-city food retailers may be facilitated by the possession of some monopoly power through the lack of effective competition, the ability to sort consumers according to their intensity of demand (known from food stamp or other welfare redemption, information from shopper club plans, etc.), and the practice of quantity restrictions on discounted items.

[2] A related literature examines racial and gender discrimination in commodities such as housing [Yinger, 1996], lending [Munnell *et al* 1996], fast food [Graddy, 1997], and automobiles [Ayres, 1991; Ayres and Siegelman, 1995; and Goldberg, 1996]. See the *Journal of Economic Perspectives* [1998] symposium on discrimination for a review.

Opponents to superstore construction counter that independent stores are just as competitive as national chains in the same markets. That is, price differentials can be attributed to the general dispersion of prices caused by cost and market differences and not to discrimination--racial or otherwise. The general idea is as follows: advocates of superstores offer anecdotal evidence of low prices at, say, the Pathmark in a nearby suburb and contend that if Pathmark operated a branch in the inner-city then poor residents could enjoy the same low prices. Opponents contend that the prices charged by the hypothesized inner-city Pathmark would reflect the general level of prices in the inner-city and not those of the suburban branch. In other words, price differences are due to different operating environments. If the latter argument is correct, then the price gap between the suburbs and the inner-city reflects equilibrium price dispersion; prices will not converge due to market heterogeneity (e.g., non-identical costs).[3] In order for policy makers to evaluate the merits of both arguments two key questions must first be answered---do the poor pay more for food? And if so, why?[4]

The empirical literature on the price gap between poor and affluent neighborhoods focuses extensively on the first question—that is, whether a price gap exists. The results from this literature are mixed. Groom [1966] and Alcaly and Klevorick [1971] find no relationship between market prices and the average income level of a neighborhood. In contrast, Kunreuther [1973] reports that low-income neighborhoods have higher prices, while Ambrose [1979] finds lower prices. More recent studies also produce a medley of results. Green [1991], Troutt [1993], and Frankel and Gould [1999] find that low-income neighborhoods have prices that are significantly higher than

[3] See Reinganum [1979] for a model of varying retailer costs that result in a non-degenerate price distribution and Pratt *et al* [1979] for evidence of price dispersion among sellers with identical characteristics.

[4] I use "poor" and "inner-city" interchangeably. In the empirical work that follows, I define the poor to be individuals residing in neighborhoods in which more than 20 percent of the residents are below the poverty level. There are alternative definitions of the inner-city which account for sociological factors typically associated with poor, urban areas such as high unemployment, low high school graduation rates, and a high proportion of single mothers [Wilson

those in more affluent neighborhoods, while MacDonald and Nelson [1991] and Hayes [2000] find no difference. There is much less research examining why prices may differ (e.g., price discrimination against the poor and racial discrimination in food retailing). Frankel and Gould [1999] find that higher prices are associated with greater income inequality. Finke *et al* [1997] find that in urban areas, low-income blacks pay significantly more than higher income blacks, and both low- and high-income whites.

Most of the prior research examines market prices through case studies. As a result, sample sizes are small with low power. Further, the importance of the surveyed items in actual consumer baskets is often unknown. More importantly, a significant portion of the studies are based on improper survey methodology--focusing on stores known to engage in unfair pricing strategies, selecting stores on the basis of proximity to volunteer surveyors, or other non-random methods.[5]

The ideal survey to answer this question would provide prices for representative poor and affluent market baskets in both poor and affluent neighborhoods. Data from such a survey would allow researchers to study whether price differentials (if they exist) are due to where the poor shop or what the poor buy relative to more affluent consumers. Further, the sample of stores would be the primary shopping venue of the household, ensuring that these data match the demographic characteristics of the household to the survey outlet. In addition to accounting for consumer tastes in outlet and product selection, consumer costs would be available as well. Most importantly, information pertaining to firm operating costs and quality (e.g., operating hours, the number of specialty departments) could be easily obtained.

1987]. I have experimented with a number of alternatives and my results are robust to different definitions. Results available from author upon request.

[5] See e.g., Groom [1966], Alcaly and Klevorick [1971], Kunreuther [1973], Ambrose [1979], Green [1991], and Troutt [1993]. MacDonald and Nelson [1991] utilize data collected by the Economic Research Service (ERS) of the U.S. Department of Agriculture. While the data are from a random sample of stores, the market basket is not identical across stores as a result of item unavailability. See Geithman and Marion [1993] for a critique of the ERS research design and methodology and Hayes [2000] for a detailed discussion of the prior literature.

In this paper, I utilize price level data collected by the Bureau of Labor Statistics (BLS) to examine whether the poor pay more for food and why. In many ways, the price data mimics that from the ideal survey. The sample frame of stores is compiled from the universe of stores where consumers actually shop.[6] In addition, the probability of selection of a particular product is proportional to its sales volume in the outlet. This allows both consumer behavior and supply factors to be accounted for simultaneously in the analysis of a price differential. I supplement the price level data with information on the service offerings, pricing strategies, and other proxies for operating costs faced by the firm. My empirical strategy allows me to distinguish Becker [1957] type racial discrimination from classical price discrimination [Pigou 1920]. I find that the poor pay up to 6.2 percent less than their more affluent counterparts after accounting for operating costs, quality, market structure, consumer search, and geographic variation. I find that poor, predominantly white (non-Hispanic) neighborhoods and poor Hispanic neighborhoods experience price discounts up to 7.7 and 19.7 percent, respectively, while poor predominantly black neighborhoods face the going price in affluent white (non-Hispanic) neighborhoods.

A brief summary of the remainder of the paper is as follows: in sections 2 and 3 I present the analytical framework and empirical strategy, providing motivation for the separation of effects due to price dispersion and price discrimination. In section 4 I describe the data. In section 5 I report results on the existence of a price differential, evaluate the explanatory power of some economic theories offered to explain the differential, and address alternative explanations for the results. In section 6 I discuss some concerns with my interpretation of the results and I conclude in section 7.

[6] The BLS collects the price data monthly to compile the Consumer Price Index (CPI). The 87 areas surveyed for the CPI are chosen to be representative of the current U.S. urban demography [Williams 1996]. The frame of outlets is derived from the Telephone Point of Purchase Survey (TPOPS) in which respondents are asked about their household income and where they purchase several categories of goods. See the Data Appendix for details.

2. Analytical Framework

Economic theory alone provides no clear answer as to whether the poor pay more for commodities--the sign of the differential is theoretically indeterminate.[7] Therefore, I control for a number of factors that may influence any estimated differentials. A natural starting point to is to divide the issues that may affect the relationship between prices and the income-level of the neighborhood into categories, incorporating some of the empirical regularities of the food retailing industry. Following this strategy, I define three broad classes of factors influencing equilibrium transaction prices: price dispersion, price discrimination, and racial discrimination.

I. Price Dispersion

The spread of prices for the same item is a well-documented phenomenon and economists have generated numerous models that predict dispersed prices in equilibrium [Salop and Stiglitz 1977; Pratt *et al* 1979; Burdett and Judd 1983]. In this paper, dispersion refers to the spread of prices attributable to differences in costs, quality, information acquisition, or market structure. This is a broad definition which encompasses spatial price dispersion (the distribution of prices for an identical item across space) and temporal dispersion (e.g., sales).

A. Operating Costs

The operating costs of food retailers include the marginal costs associated with a sale, quality-induced costs, and discretionary costs. According to the Food Marketing Institute (FMI)

[7] The neoclassical model under perfect competition and the Bertrand duopoly model predict that firm prices should be the same in equilibrium (and equal to the marginal cost of the homogenous good) regardless of geographical location. However, the Bertrand model with product differentiation and Hotelling's spatial-monopoly model can generate higher prices in poor neighborhoods. For other models that predict price differences see Rothschild [1974]; Butters [1977]; Salop and Stiglitz [1977]; Varian [1980]; and Burdett and Judd [1983]. In addition, there are models of price

[1997], labor and rental property comprise 12 and 2 percent of sales, respectively. FMI [1997] estimates that payroll and employee benefits account for almost 54 percent of total operating cost for food retailers---more than the cost of supplies and insurance premiums combined. Labor costs are particularly high in seafood, bakery, and foodservice specialty departments [*Supermarket Business*, 1998]. In addition to providing a service, specialty departments are proxies for the quality-level of a supermarket. For example, only large, modern supermarkets contain in-store bakeries (where baking is done on the premises) and seafood counters. Discretionary costs include promotional activities, such as advertising, in-store demonstrations, and loyalty-card programs.

Table 1 provides descriptive statistics on the average store characteristics in the U.S and the average characteristics for stores in the BLS sample that is analyzed in this paper. A comparison of columns (4) and (5) of the table shows that BLS sample stores operating in low-income areas employ less labor and are less likely to be a branch of a chain.[8] Since chain status proxies economies of scale in purchasing, the lower proportion of chain stores may signal higher average inventory costs for inner-city retailers. Columns (4) and (5) of the table also show the average discretionary costs and offered services for stores operating in low-income and high-income areas. Stores operating in the inner-city have lower expenditures for double-coupon, frequent shopper, and in-store discount activities. These activities encourage consumers to self-select into categories, which results in efficient promotional targeting. Not surprisingly, the greatest divergence between inner-city stores and stores operating in affluent neighborhoods occurs in the quality of the shopping experience. On average, inner-city stores have less specialty departments and offer fewer services.

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discrimination and bargaining in which a gap in mean prices paid by different groups may not exist, yet price discrimination occurs through differences in the variance of the price distribution [Goldberg, 1996].

B. Information Acquisition

Despite the well-developed theory of consumer search, empirical findings are limited.[9] Alcaly [1976] finds that search activity by income group is positively related to the group's income elasticity of demand for the product. In an empirical test of joint search using food prices, Carlson and Gieseke [1983] find search behavior moderately increases for low-income consumers.

While theory predicts that increased search from an unchanging price distribution lowers the average transaction price, it is an empirical question as to whether the poor search more. It is possible for search costs to be inversely related to income over some range.[10] One can imagine a situation in which the discount resulting from search is less than the low-income consumer's search costs resulting in the consumer visiting and purchasing from the first store (no search). As the wage rate rises, there are two competing forces influencing search. Higher income increases the opportunity cost of time and lowers search activity. However, increased income also allows the consumer to purchase better information from the information market resulting in more search [Mincer 1963]. Further, direct costs (e.g., transportation costs) lower the marginal cost of search for the rich relative to the poor. So while the poor have a lower opportunity cost of time as measured by the wage rate, it is not clear whether the poor engage in greater search for the same product [Alcaly 1976]. In my empirical analysis, I proxy search costs with the proportion of households without a vehicle, the proportion of residents attaining a given educational level, and the number of stores in the neighborhood (per square mile) interacted with the neighborhood

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[8] I do not have information on wages and usual hours worked. Using data from the Current Employment Statistics (CES) to proxy the average wage, I find that stores in inner-city areas incur a lower wage bill. However, due to the measurement error inherent in this calculation, I use the level of employment in the empirical work that follows.

[9] The theoretical literature on consumer search behavior is extensive [see e.g., Nelson 1970; Butters 1977; Salop and Stiglitz 1977; Burdett and Judd 1983; and Diamond 1987]. Stigler [1961] argues that search should occur more for goods that comprise a large share of income. Mincer [1963] shows the estimation of income effects may be biased when the relative costs of search are ignored. Mincer also shows that the poor should pay less for necessities.

poverty rate.[11] Table 1 shows descriptive statistics for these variables. A comparison of columns (4) and (5) shows that households residing in low-income areas are three times less likely to own a vehicle and residents are almost twice as likely to drop out of high school.

C. Market Structure

Supermarkets comprise 24 percent of all food retailers but account for 77 percent of total food sales. Convenience stores account for 45 percent of all retailers and 6 percent of total sales, while warehouse and wholesale clubs combined account for less than 1 percent of outlets but 5 percent of total sales.[12] The supermarket industry is regionally competitive and dynamic. Regionally, more than 85 metropolitan statistical areas (MSAs) have four-firm concentration ratios in excess of 80 percent [Geithman and Marion 1993].[13] Nationwide, the top four companies account for 20 percent of annual sales and almost 20 percent of individual supermarkets.[14] Despite the fact that four companies own a large share of individual stores, supermarkets are not very concentrated nationally; Albertson's acquisition of American Stores in 1998 made it the first supermarket with operations coast to coast.[15] Finally, the industry is constantly changing due to an average of 54 mergers/acquisitions each year [Kinsey 1998]. However, the number of stores remains fairly constant as entry and exit are nearly equal [USDA 1996].

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[10] See Alcaly [1976] and Frankel and Gould [1999] for models with this property.

[11] Determining the variables and functional form to characterize search rules empirically is very difficult and the literature does not offer much guidance. I experimented with a number of different specifications of search. In my empirical work I assume search costs to be linear in income and transportation costs, and non-linear in education.

[12] *Progressive Grocer* [1999], p.10.

[13] The four firm concentration ratio is the sum of the four largest market shares in the industry:

$$R_m \equiv \sum_{i=1}^{4} \alpha_i ,$$

where $\alpha_i \equiv q_i/Q$ is firm *i*'s market share and the firms are ordered such that $\alpha_1 \geq \ldots \geq \alpha_4 \geq \ldots \geq \alpha_n$.

[14] The Food Institute [1998]. In 1998 the top four food retailers were Albertsons, Inc., The Kroger Co., Wal-Mart Stores, Inc., and Safeway, Inc.

[15] There is no consensus as to whether concentration increases price in this industry. The most comprehensive studies find polar results. See Marion *et al* [1979] and Kaufman and Handy [1989].

Column 2 of table 1 shows the means of the market structure variables I use in the empirical analysis. Surprisingly, columns (4) and (5) of the table show that there are significantly more stores (per square mile) in the inner-city than in more affluent neighborhoods, although these stores are smaller on average.

II. A "taste" for discrimination

I also investigate the possibility of Becker [1957] style discrimination, which results in higher prices in certain neighborhoods because of the *perceived* higher cost of conducting business. In Becker discrimination, retailers act as if $c_i(1+d_k)$ were the true marginal cost of providing item i, where d_k is the discrimination coefficient against group k. Becker-style discrimination differs from classical price discrimination in that it results in differential prices for non-economic reasons; price differences are not driven by differences in the costs of service or differences in the intensity of demand of the discriminated group.[16] While it is possible for Becker-type discrimination against the poor, I limit my examination to the possibility of racial/ethnic discrimination by retailers. In order for racial discrimination to be ascertained price differences must be net of costs. Empirically, Becker-type racial discrimination is identified by the assumptions that retailers cannot segment their market on the basis of race (i.e., race is not identifiable through sales receipts) and demand intensities and costs do not vary by race. These factors render discrimination by race less profitable than a nondiscriminatory pricing strategy. In contrast, classical price discrimination is at least as profitable as a nondiscriminatory policy due to the extraction of consumer surplus [Phlips 1983].

[16] This is clearly seen in the mark-up. The Becker-type discriminator prices according to:

$$p_{ijk} = \frac{c_i(1+d_k)}{1-(\alpha_j/\varepsilon)},$$

where α_j is firm j's market share and ε is the elasticity of demand. Only d_k differentiates him from his competition and d_k is unrelated to marginal costs or demand intensities.

III. Classical price discrimination

In order for price discrimination to be a viable strategy a retailer must have monopoly power, the ability to segment the market according to the intensity of demand, and the capability to prevent resale of the product. A corollary to the second condition is that the intensity of demand must actually differ across segmented groups. Consumer behavior, which includes price sensitivity and preferences, is one reason poor and affluent demand elasticities may differ.

The marketing literature concerning price sensitivity is vast, yet studies focusing on the demand elasticities of poor consumers are limited. In a case study of Dominick's food chain, a major chain in Chicago, Hoch *et al* [1995] find that price sensitivity is inversely related to educational attainment and dwelling value, while positively related to family size and the proportion of working women in the census tract surrounding the store. Research on the substitution patterns and preferences of poor consumer units are also limited. Alwitt and Donley [1996] report that poor consumers purchase more "filling" goods (e.g., rice and pasta) and preparation goods (e.g., flour and sugar) than affluent consumers. In a case study of households in New Haven, Kunreuther [1973] finds that low-income residents are more likely to purchase smaller container sizes and shop at their local food store. In terms of consumer shopping preferences, Polakow [1993] finds that recipients of food stamps are less likely to shop outside of their neighborhood for fear of being stigmatized by cashiers and others. Reynolds and Darden [1972] find "out-shoppers," consumers who shop outside of their residential area, are typically affluent. Studies of store versus brand substitution utilizing scanner data find that within-store substitution (brand switching) is significantly greater than between-store substitution [Kumar and Leone 1988;

Walters 1991], indicating that consumer behavior may play a large role in reducing the effective competition faced by an inner-city store.

A. Identifying classical price discrimination

I assume that segmentation of the market along income lines is possible through the use of sale receipts. For example, the retailer can distinguish the poor from the affluent by the poor consumer's use of food stamps, vouchers (e.g., the Women, Infants, and Children (WIC) program), or other governmental in-kind transfers.[17] In order to ascertain the presence of price discrimination, price differences must be net of costs. As discussed above, I interpret price differences due to costs, quality, market structure, information acquisition and geographic variation as price dispersion.[18] I interpret the residual variation in price not explained by racial discrimination or the above factors as price discrimination. While I expect richer households to purchase more on average for normal goods, my goal is to identify whether there are differential prices in low-income neighborhoods after controlling for differences in market environment. I label such price differentials as price discrimination, which can result in either higher (premium) or lower (discount) prices. In order for price discrimination to result in higher prices in equilibrium, the propensity to exploit the captive market must overshadow the inverse-elasticity rule.[19]

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[17] This is a conceptual distinction necessary to identify price discrimination from Becker-style discrimination against the poor, which is discussed in the preceding section. While the retailer can calculate the probability of serving a poor consumer based on the proportion of poor households in his service area, he cannot reasonably predict what they purchase. Such a prediction would lead to inefficient pricing strategies, as compared to segmentation along a known demand curve.

[18] It is possible for quality to be used as a tool to sort consumers, enabling price discrimination. I regard the quality of the shopping experience to be exogenous.

[19] The inverse-elasticity rule posits that higher prices should be charged to consumers with relatively low elasticities of demand.

3. Empirical Framework

Measuring the net price differential

My empirical strategy is to try to account for variation in price levels due to costs and quality so as to isolate the relationship between the neighborhood income level and market prices. To begin, I first estimate price differentials by analyzing market prices in poor and rich neighborhoods for homogenous products. Because theory provides little guidance on the functional form, I estimate the following semi-log model:

$$\ln p_{ijzst} = \gamma_i + \beta_1 \text{Poor}_z + R_z \Delta + \left(R_z * \text{Poor}\right)\Psi + X_{jz}\Pi + Z_{ijt}\Phi + \omega_s + \upsilon_{ijzst}, \tag{1}$$

where p_{ijzst} is the unit price plus applicable sale taxes of item i in store j located in neighborhood z at time t; γ_i is the homogenous item fixed effect; $Poor_z$ is an indicator variable which equals 1 if the neighborhood is low-income; R_z represents race and ethnicity indicator variables; Ψ is the vector of coefficients on the race/ethnicity and poor interaction terms; X_{jz} represents a set of covariates (operating and discretionary costs, consumer search, quality, market structure, and neighborhood demographics); Z_{ijt} is a set of other covariates to be discussed below; ω_s is the regional fixed effect; and υ_{ijzst} is a random error term that can be decomposed into:

$$\upsilon_{ijzst} = \eta_j + \varepsilon_{ijzst}, \tag{2}$$

such that,

$$E\left(\upsilon_{ijzst}, \upsilon_{ikzst}\right) = \sigma_\eta^2 = \left[\frac{\sigma_\eta^2}{\sigma_\eta^2 + \sigma_\varepsilon^2}\right]\sigma^2 = \rho\sigma^2, \forall j \neq k, \tag{3}$$

Specification (1) resembles the approach used in the literature, with the exception of the covariates X_{jz} and R_z that are typically omitted. As discussed in section 2, income plays a multiple role---at once representing the identifiable characteristic used by retailers to segment consumers for price discrimination, in addition to representing gross demand and the cost of search. Despite embodying these multiple affects, the coefficient β_1 can only be positive in a limited number of ways. Assuming the good is normal, the first possibility is for the search effect to dominate the income effect in such a way that the rich search more *á la* Mincer [1963] and pay lower prices. Rothschild [1974] and others provide strong arguments against this contingent. The second, and more plausible, possibility is through price discrimination where the exploitation of the captive market is more profitable than pricing according to the inverse-elasticity rule.

I estimate the above specifications using a sample restricted to homogenous items priced in almost every survey region. While this is the best procedure to avoid comparing the prices of "apples and oranges," it does not exploit the rich information on product characteristics in the data that permit the analysis of a much larger set of prices. To account for product varieties, I augment equation (1) by including a set of detailed product characteristic indicator variables, K_{it}, in the regression. This approach increases efficiency and resembles the method most commonly used in the quality-adjusted indexing literature (see e.g., Primont and Kokoski [1990, 1991], Moulton [1995]). Constraining the slopes of the characteristics to be constant between primary sampling areas, I estimate the following:

$$\ln p_{ijzst} = \gamma_i + \beta_1 \text{Poor}_z + R_z \Delta + \left(R_z * \text{Poor}\right)\Psi \qquad (4)$$
$$+ X_{jz}\Pi + Z_{ijt}\Phi + K_{it}\Lambda + \omega_s + \upsilon_{ijzst}.$$

Measuring item dispersion

Equation (4) estimates the *average* net price differential across poor neighborhood types. While the average net price difference is informative, it has two major drawbacks for this analysis. First, the average price differential constrains the relationship between price and the income status of a neighborhood to be the same for each item. Anecdotal evidence suggests that item prices vary widely therefore this constraint is unreasonable. Second, the weighting scheme employed in the estimation of the average price differential does not account for the relative importance of items in the market basket of poor consumers. To analyze item price dispersion across neighborhood types, I estimate a modified version of specification (1) by item for the poor and rich separately:

$$\ln p_{ijzst} = \alpha_0 + \beta_i I_z + X_{jz}\Pi + Z_{ijt}\Phi + \omega_s + \upsilon'_{ijzst}, \tag{5}$$

where I_z is the median household income of the neighborhood *z*. While I can compare the differences in β_i between the poor and the rich, such a difference does not measure the concept of classical discrimination discussed above. This is because high prices for certain goods may be offset by low prices for other goods across neighborhood types. The concept of price discrimination outlined above seeks to capture the situation in which the net result of all pricing strategies is higher prices in poor neighborhoods. To address this, I derive an aggregate measure that weighs the price differences across items by the expenditure shares of the poor. The net price differential in poor neighborhoods is then:

$$\overline{\beta}_{poor} = \sum_{i=1}^{I} s_i \hat{\beta}_i, \tag{6}$$

where s_i is the relevant food category expenditure share for low-income consumers taken from the Consumer Expenditure Survey (CEX), and β_i refers to the estimated price difference in specification (5).

In summary, I first examine mean gross price differences and relative dispersion. My regression analysis begins by estimating the relationship between the market price and income level of the neighborhood using prices for homogenous items priced in almost every sampling area. I initially impose many restrictions on the price relationship (the price differential is assumed to be the same across sampling areas, as are operating costs and other covariates), then gradually relax the assumptions. In my most general specification, I derive an overall measure of the relationship between price and income that is simply the weighted-average of the individual item differences, where the weights are item budget-shares. This final measure, $\overline{\beta}$, can be interpreted as the price differential which accounts for the relative importance of items to the low-income consumer. A comparison of $\overline{\beta}_{\text{poor}}$ to $\overline{\beta}_{\text{rich}}$ yields another measure of price discrimination.

4. Data

I. BLS Data

The BLS collects the price data analyzed in this paper to compile the monthly CPI. The BLS data are uniquely suited for the analysis of income price differentials for several reasons. First, the prices are national in scope. The BLS selects 87 urban regions in the U.S. to survey based upon various demographic factors.[20] Map 1 shows the distribution of BLS survey areas. Although the survey is limited to urban areas (encompassing 86 percent of the population), the map shows sampling areas to be geographically diverse. Second, the BLS prices are representative of where consumers shop and what they actually purchase. This is because the sampling strategy derives the frame of survey outlets from the Telephone Point of Purchase Survey (TPOPS), a separate unpublished consumer survey. Once the outlet is selected based upon total expenditures, the unique item to price is selected using probability proportional to sales.[21] These selection techniques imbed consumer behavior in the collected price, which is essentially the market price.

[20] The primary sampling units are selected based upon the following factors the BLS finds to be highly correlated with price change: region, population size, mean interest and dividend income per housing unit, mean wage and salary income per housing unit, percent of housing units heated by electricity, percent of housing units heated by fuel oil, percent black, and percent retired. See *BLS Handbook of Methods*, chapter 17.
[21] See the Data Appendix for details on the BLS sampling strategy.

Another benefit of the BLS sample is that prices are collected from a variety of neighborhood types, allowing the study of the average poor consumer. Finally, the BLS weights price indices to be representative of the nation. Therefore using their sample, properly weighted, results in representative national price differentials.

One potential drawback of the BLS data is that the same item is not priced everywhere, raising concerns of comparability. I avoid comparing "apples and oranges" in two ways. I first limit my analysis to five homogenous items surveyed in the majority of sampling areas. I then employ detailed characteristic controls for more heterogeneous products. Product characteristics explain a significant portion, 59 to 92 percent, of the variation in prices. Another concern is related to the unique item selection process, which does not account for product availability. For example, it is not fair to compare Brand 1 flour at store 1 to prices at other stores when store 1 only stocks Brand 1. This procedure is appropriate for a price index reflecting inflation, but is a concern for comparing price differentials because the lack of choice can be regarded as a price premium. If product choice is negatively correlated with the neighborhood income level, then my estimate of the net price differential will be downward biased. This is a real possibility as stores in low-income neighborhoods tend to be substantially smaller than average.

I limit my analysis to prices from the food and beverages major group of the CPI. I further limit my sample to the following products: flour, white bread, ground beef, pork chops, whole chicken, eggs, milk, bananas, oranges, potatoes, lettuce, non-carbonated juice, and salad. The analysis sample consists of 63,557 prices from 2,181 stores in 43 states over the 12 months of 1998.[22] Columns 1 and 2 of Table 1 compare the means for selected demographics of my analysis sample to all neighborhoods in the U.S. As expected, the analysis sample differs significantly from

[22] The BLS does not survey Montana, North Dakota, and Wyoming. Further, my analysis sample does not contain stores in Iowa, Maine, New Mexico, Rhode Island, and West Virginia.

the average neighborhood in the U.S., reflective of the CPI's goal of tracking inflation in urban areas.[23]

II. Outlet information

Since the price data contain only address information and store type, I supplement them with more extensive data from SPECTRA, Inc., a private marketing firm.[24] The SPECTRA sample consists of 19,836 observations on supermarkets, grocery stores, and large-scale discounters and provides information on service offerings, outlet size, and costs. Columns 2 and 3 of Table 1 report the means of selected covariates for the BLS sample and the subsample for which I have SPECTRA data. The subsample generally resembles the entire BLS sample.[25] I use additional data from InfoUsa, Inc., a private marketing firm, to derive measures of competition from the number of stores in a zip code. I use the 1990 Census, Summary Tape File 3B, to obtain demographic data by zip code.

III. Racial and ethnic composition

I measure the racial and ethnic composition of a neighborhood using dummy variables based upon segregation indices calculated at the county level. I utilize the dissimilarity [Duncan and Duncan 1955] and isolation [Bell 1954] indices.[26] The dissimilarity index proxies whether two groups are evenly distributed throughout an area. The index varies from 0 to 1 and is minimized when all parts of a county have the same relative number of minority and majority members as the

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[23] There are no significant differences when the BLS sample is compared to all urban neighborhoods in the U.S.

[24] The match rate is approximately 78 percent. In adherence to the confidentially of the data, I do not reveal outlet names and product brands in this analysis.

[25] See Appendix Table 1 for a comparison of the full SPECTRA sample to the BLS outlet sample. The table reveals that the SPECTRA sample consists of stores of various sizes located in a diverse set of neighborhoods.

county as a whole. At a value of 1, only minority members inhibit the county. The index of isolation measures the extent to which minority members interact with only minority members. It is intended to capture the characteristic of exposure. The index of isolation is minimized when the minority group is a relatively small proportion of the county, so that the minority group will have to interact in some capacity with the majority.[27] This index also varies from 0 to 1, with higher values indicating a greater isolation from the majority population. I define a predominantly black county as one in which the index of isolation exceeds 0.3.[28] Similarly, I define a predominantly Hispanic county as one in which the Hispanic index of isolation exceeds 0.3. In the empirical work below, I refer to "black neighborhoods" and "Hispanic neighborhoods" as indicating neighborhoods located in predominantly black counties and Hispanic counties, respectively.

5. Estimation results

I. Summary statistics

Table 1 presents the means of the covariates I use to represent the factors that may influence price levels. I group the covariates according to the primary mechanism through which they may affect price. The top rows of Table 1 show the means of the various racial and ethnic neighborhood classifications I use. The top-most four rows show the proportion of predominantly black or Hispanic counties in the BLS sample as a whole in column (2) and by poverty status in columns (4) and (5). Neighborhoods located in predominantly black counties are significantly more likely to be

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[26] Segregation indices are used extensively in the sociology literature. The index definitions I use are based upon Massey and Denton [1988]. See the Data Appendix for the mathematical definitions.

[27] While I utilize the conventional dissimilarity and isolation indices only, Massey and Denton [1988] propose three other indices intended to capture the concentration, centralization, and clustering aspects of segregation. As these indices require detailed geographic information, I do not use these indices in the analysis.

[28] I have experimented with a number of alternative definitions, including defining a predominantly black neighborhood as one in which the index of dissimilarity exceeds 0.6 and the index of isolation exceeds 0.3---the definition used in Cutler, Glaeser, and Vigdor [1997]. See Table 2 for comparisons. The proportion of counties

poor than affluent, using either measure of racial composition. This is also true for predominantly Hispanic neighborhoods.

The remainder of Table 1 shows the means of the other cost, consumer search, quality, and market structure covariates. Given that most of the variables that proxies for search costs are significantly different for the poor, it is likely that search may explain a portion of the price patterns. The table shows residents of poor neighborhoods are 65 percent less likely to own a vehicle and almost 50 percent more likely to drop out of high school. According to Mincer [1963], direct search costs such as transportation decrease the marginal cost of search for the rich relative to the poor. As expected, the rich incur less direct costs of search as measured by these variables.

In terms of the operating cost variables presented in the table, stores operating in non-poor neighborhoods provide quicker checkout as measured by the number of available cashiers, greater availability of service or replenishment of products as represented by the number of full- and part-time workers, and on average, more opportunities to enjoy discount prices. As expected, stores in affluent areas are of higher quality, offering a significantly different mix of services. Although crime is significantly higher in poor areas, the table indicates that it is more costly to do business in non-poor areas.[29]

II. Mean gross price differences

I first limit my analysis to five homogenous items--milk, whole chicken, eggs, navel oranges, and Iceberg lettuce--that are priced in almost all sampling areas. Table 2 shows the mean

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satisfying this condition differs from that in Cutler, Glaeser, and Vidgor [1997] because of my use of zip codes as my neighborhood proxy and the calculation of segregation at the county level. See the Data Appendix for details.

[29] Insurance costs for supermarkets comprise less than 0.5 percent of sales [FMI 1997]. Even if insurance costs were 50 percent higher for stores operating in low-income areas, such costs would continue to be smaller in magnitude and importance than labor, utilities, and supplies.

(gross) price differences for these items by alternative definitions of poor neighborhoods.[30] The table shows that there is a significant discount for chicken (0.06 dollars lower) and eggs (0.12 dollars lower) when poor neighborhoods are defined as being in the 80th percentile of the state poverty distribution. The significance of the discount for eggs disappears when the definition of poor changes to the 90th percentile of the state poverty distribution. Under this definition, the only significant difference is for poultry, where the price is 0.09 dollars lower per pound in poor neighborhoods. When prices are allowed to vary nonlinearly across neighborhood types, there is a statistically significant difference in orange and lettuce prices of 0.16 and 0.10 dollars per pound, respectively, between the first and fourth quintiles (where the first quintile consists of the most affluent neighborhoods), suggesting that the poor pay less. Similarly, concentrated poverty neighborhoods (as represented by the fifth quintile) have prices different from those in the first quintile only for eggs, with eggs being 0.14 dollars cheaper in poor neighborhoods. All other differences are not statistically significant.

Two patterns are evident in this table. First, all of the price differences are either zero or negative, indicating that market prices are lower in poor neighborhoods on average. Second, the small significant differences that do appear are not constant across definitions, indicating that the gross price discounts are not robust to alternative definitions of the poor. Price differences are stable across the poverty distribution for milk, chicken, and eggs and the last quintile (which is equivalent to 80th percentile of the state poverty distribution) is sufficient to model the relationship between price and neighborhood income status.[31] However, this is not true for oranges and lettuce, which show differences in other quintiles.

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[30] The definitions used in the table are based on relative measures of poverty in which the percentiles are based on the state poverty distribution.

[31] Based on F-tests by item constraining the dummy variables for the other quintiles to be zero.

Table 3 presents the average price differential across neighborhoods classified according to the racial and ethnic composition of the county. Prices in neighborhoods located in predominantly black counties are largely the same as those posted in predominantly non-black counties. The only significant difference occurs in milk prices, for which consumers in black neighborhoods are charged 0.15 to 0.21 dollars more, depending upon the definition.[32] The lower half of Table 3 shows average price differences between Hispanic and non-Hispanic counties. Significant differences in prices occur for chicken and lettuce, with market prices being 0.14 dollars per pound higher for chicken and 0.07 dollars per pound lower for lettuce. There is a marginal difference in the price (0.19 to 0.26 dollars higher) for milk.

While there appears to be no clear pattern of gross price differences between poor and affluent neighborhoods, this result could be due to differences in price variation between the neighborhoods. To investigate relative dispersion across neighborhood types, I calculate the difference in the cumulative density functions of the neighborhood gross prices.[33] Figure 1 shows the dispersion in gross prices for poor and affluent neighborhoods for milk, chicken, and lettuce. The price distribution in poor neighborhoods appears to lie to the left of both the mean and the price distribution in affluent neighborhoods. Although Table 2 did not reveal a significant difference in mean prices by poverty status, the poor-affluent difference in the cumulative density functions (CDFs) for all items is positive and significant, indicating a greater likelihood of lower prices in poor neighborhoods. The opposite pattern is evident in racial/ethnic neighborhoods as shown in Figures 2 and 3. The difference in the CDFs between these neighborhoods and their

[32] Milk is a special commodity because its price is somewhat regulated through price supports. In fact, milk prices were at a uncharacteristic high throughout much of 1998 due to a decrease in supply [The Associated Press 1998]. This may partially explain the positive differential as prices were significantly higher in the northeast and mid-west. However, my tabulations show that gross prices in black neighborhoods continue to exceed those in non-black counties within the northeast and mid-west regions. Table 2 shows that income also does not explain this difference.

[33] I calculate the kernel density estimates of the gross prices using the Epanechnikov kernel.

counterparts is largely negative and significant, indicating a higher probability of higher prices in black/Hispanic neighborhoods.

In summary, gross prices do not appear to be higher in poor neighborhoods. If anything, it appears that gross market prices may be lower on average in low-income neighborhoods. The relationship between neighborhood racial and ethnic composition and price is less clear. Neighborhoods located in Hispanic counties have higher gross prices for two of the five goods, and significantly lower prices for one item. The differences in CDFs indicate that pricing strategies vary by item and neighborhood composition and may result in a greater likelihood of premiums in minority neighborhoods. However, caution must be exercised as these are patterns in gross price differences, unadjusted for differences in operating costs, quality, and consumer search.

As I begin to add covariates in subsequent work below, I follow the literature and define poor neighborhoods as those in which more than 20 percent of the households are below the poverty level. I also define black and Hispanic neighborhoods to be those in which the county index of isolation exceeds 0.3.

III. Explaining the (non-)existence of a price gap

Table 4 presents the main results of this paper. The table isolates the relationship between price and the poverty and racial/ethnic neighborhood composition from other factors such as costs, quality, and consumer search by sequentially adding other covariates. The top panel of the table shows the average poor price differential. All regressions include a constant, month dummies, and item fixed effects. In addition, with the exception of columns (1) and (10), all regressions include product size and a dummy variable for whether the price is a sale price. These latter variables comprise the Z_{ijt} in equation (1).

As indicated by comparing mean prices in Table 2, the poor pay approximately 6 percent less for these goods. Controlling for neighborhood demographics and crime increases the discount, while the other factors decrease the discount. Each change in the discount from the prior column occurs in the expected direction for all of the factors. For example, when discretionary costs are unaccounted for in column (5), the price differential is larger than when such costs are included as in column (6). Since discretionary costs and price are very likely positively correlated, the coefficient reported in column (5) may be upward biased.[34] The final column shows that after accounting for many factors to represent price dispersion, the net price gap is about the same size as the gross price gap but the difference is now insignificant.

To examine the role that race/ethnicity plays, I analyze the price gap by these subpopulations of the poor. The second panel presents these results, where the coefficients are the sum of the poor and race/ethnicity main effects and interaction.[35] For example, the poor, predominately Hispanic discount of 21.7 percent in column (10) is the sum of the poor and Hispanic main effects and interaction term.[36] The discount is relative to affluent, predominantly (non-Hispanic) white neighborhoods.

Controlling for neighborhood demographics, crime, and operating costs in columns (12) through (14) does not affect the poor white coefficient appreciably, while the Hispanic price discount further increases. The lower panel of the table, which reports the p-values from the joint test that the covariates differ from zero, reveals that the lack of movement may be due to the insignificance of the additional covariates. The inclusion of the discretionary cost and market

[34] This assumes that discretionary costs are higher in poor neighborhoods, which is supported by the data.

[35] One concern about testing for the price difference by income and race/ethnicity is that the measures are highly correlated. As a result, one may not be able to separately identify effects. The correlation between race and poverty and ethnicity and poverty is 0.138 and 0.132, respectively. While these correlations are positive and significant, a comparison of the coefficients from regressions sequentially accounting for income, race/ethnicity and their interaction reveals sufficient variation.

structure variables shifts the poor subgroup coefficients negligibly. In contrast, the inclusion of the search covariates increases the poor white and Hispanic coefficients. The lower panel shows that the search variables contribute significantly to explaining the additional variation in prices not accounted for by race, poverty status, and the other covariates. Overall, the inclusion of the covariates decreases the price discount in poor predominately (non-Hispanic) white and Hispanic areas. Net prices in poor black neighborhoods are essentially the same as those in affluent (non-Hispanic) white areas. The table clearly shows that the net price differential across poverty neighborhood subgroups is negative or zero. There is no evidence of the poor paying more for food.[37]

Overall, the results appear to be consistent with price dispersion, as the significance of the average poor price gap (top panel of Table 4) disappears after controlling for a number of cost factors. However, the robust negative price difference provides some evidence that classical price discrimination may play a role in the explanation as well. This is because the price discount may be a result of firms reacting strategically to the higher demand elasticities of poor consumers with lower prices.[38] In addition, the results appear to be consistent with imperfect information models that relate relative prices paid to search costs (see e.g., Salop and Stiglitz, 1977).

While there are no differences by race, ethnicity does matter. In fact, poor predominantly-Hispanic neighborhoods have the largest discounts, a result that is robust to cost and classical price discrimination explanations. One possible explanation of this pattern "reverse" Becker-type discrimination. As stores in Hispanic neighborhoods are likely to be owned by other Hispanics [Bates 1995], the price discount could reflect a preference to serve one's own community.

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[36] The discount is larger for the model allowing item and poverty interactions with ethnicity, which is presented in Appendix Table 2. All other results are similar qualitatively.
[37] I have also analyzed a more heterogeneous sample of over 35,000 prices over several other items. The results are qualitatively similar.

IV. Item price dispersion

The analysis performed above estimated the empirical specifications (1) through (4) outlined in section 3, in which the item characteristics are constrained to be the same across neighborhood types. This procedure is most similar to what has been done in the literature and is the conventional approach for this type of survey data (see e.g., Primont and Kokoski 1990, 1991). Two main conclusions can be drawn from the results presented. First, the poor coefficients are generally negative or zero. Second, the covariates contribute significantly to explaining the variation in prices and the point estimates are fairly robust to their inclusion. However, as the number of variables in the models presented are large (e.g., there are 127 model degrees of freedom in the model estimated in column (18), Table 4), the pattern of interactions among the product characteristics is unknown. In order to allow the price differential and product characteristics to vary freely, I follow an alternative weighting strategy which allows each item price to fluctuate within each neighborhood type. I do this by estimating empirical specification (5) by item for each neighborhood type and deriving a weighted-sum of poor-price differential from each model using the poor expenditure shares taken from the CEX as weights.[39] Because I evaluate the price gap for poor and affluent neighborhoods separately, I substitute a continuous measure of neighborhood income (e.g., median household income) for the poor indicator variables used in the above analysis.[40]

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[38] Hoch *et al* [1995] estimate food demand elasticities and find low-income consumers to be more sensitive to price changes.

[39] Consumer Expenditure Survey [1997], Table 2.

[40] I use this measure in lieu of the continuous poverty rate because of collinearity problems in the poor neighborhood sample. Multicollinearity is encountered in this procedure because of the smaller sample sizes and relatively large set of covariates.

To explore the effects of pooling on the regression results presented above, I show the averages with and without covariates for the homogeneous items in Table 5a. The coefficient on median household income varies a great deal across items and by neighborhood type. For example, in column (2) milk prices increase significantly (25 percent) as income increases one unit for the poor but column (12) shows no relationship between income and price for milk in affluent areas. In general, the variation across items is enlarged by the inclusion of the full set of covariates, showing that the explanatory power of the covariates differs across items.

The bottom panel of the table calculates the weighted average of the income coefficients ($\overline{\beta}$), with and without covariates. The weighted-average of the income coefficients without covariates for the poor neighborhoods is essentially zero. The result of no relationship between the median household income of a neighborhood and market prices has been reported by a number of researchers (e.g., Groom [1966] and Alcaly and Klevorick [1971]). However, the weighted-average of the income coefficients with covariates for the poor neighborhoods is large and significantly different from zero, indicating that prices increase 42.7 percent as median household income increases one unit (or 10,000 dollars). This is in contrast to the weighted-coefficient in affluent neighborhoods, which is negative and insignificant. I interpret these results as suggesting that prices are more sensitive to income in poor areas. The average of the β's indicates that, given a one-unit increase in the income level of a neighborhood, prices are more likely to increase.[41]

Tables 5b and 5c repeat the above analysis by racial and ethnic composition. There is no systematic relationship between prices and racial composition in Table 5b. The income coefficients are generally insignificant and the expenditure-weighted averages are insignificant. In contrast, there appears to be a significant relationship between price and predominantly Hispanic and non-

[41] I have also conducted this analysis on a larger, more heterogeneous sample of items. The results are qualitatively the same.

Hispanic neighborhoods in Table 5c. The bottom panel of the table shows a positive and significant difference in the weighted average income coefficients without covariates, indicating that prices increase faster (on the order of 5.5 percent) with a one unit increase in median household income. This result completely reverses once costs, quality, consumer search, and store format are taken into account. The covariance-adjusted difference in weighted-averages is negative and significant, suggesting that net prices may in fact be regressive in predominantly Hispanic neighborhoods. The overall effect of a one-unit increase in income is null, as the Hispanic and non-Hispanic effects exactly offset each other.

The weighted-coefficients $\overline{\beta}$ verify the earlier results. In more concentrated poverty areas, the poor do not face higher prices. Although the pricing strategies in relation to income differ across products, these strategies do not result in higher prices in the inner-city. One interpretation of this is that price discrimination may be a local phenomenon: stores may exploit poor consumers for some products but on average this practice does not result in the entire market basket price being higher than in affluent areas.

V. Other explanations

The results from the comparison of means and the above regression analysis indicate that the net price discount in poor neighborhoods ranges between zero and 6.1 percent. While informative, this is a large range so it is helpful to examine other possible explanations that may affect the net price differential. One such explanation is the format of the store. While the above analysis accounted for the possible economies of scale experienced by chain stores, I did not explicitly account for differences in prices across store formats, which may be substantial. For example, while both Wal-Mart and Kroger's are chain stores they practice very different pricing strategies.[42]

Table 6 examines whether prices may differ by the type of store. A superstore is a supermarket with at least 30,000 square feet in retail space and annual sales in excess of 12 million dollars. Superstores offer a variety of specialty departments and services. A conventional supermarket is any full-line, self-service grocery store with annual sales of 2 million or more.[43] The top panel of the table reveals significant differences across store types for the homogenous items, with discounts at superstores (23 percent). There are negligible differences at other store types. The lower panel reiterates the above results, showing significant discounts only at superstores for all poor neighborhood subgroups relative to affluent white neighborhoods. These findings suggest that the poor do not pay more given the store type they frequent most, and they stand to gain by shopping at superstores.

Columns (4) and (5) and (13) and (14) of Table 6 show estimates of the net price differential for central city and suburban neighborhoods.[44] The differentials are insignificant in both the central city and suburbs, and not statistically different from one another. Columns (13) and (14) of the table presents the differentials for poor neighborhood subgroups. Again, the differences in the coefficients by central city status are not significant. In contrast to MacDonald and Nelson [1991], I find no difference in the price differential between poor central city and poor suburban neighborhoods.

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[42] This example should not be construed to imply that prices from either Wal-Mart or Kroger's are represented in the data.

[43] Store format information is based on data from Spectra Marketing, Inc. While I do not know the actual store format from the Spectra data for the stores in the last column of the table, the operating names indicate that this column contains bakeries, delicatessens, vegetable stores, independent supermarkets, etc. Estimates for warehouses are omitted due to collinearity between the poor indicator variable and other covariates.

[44] I define an area as being located in a central city if the zip code of the store is located in a MSA declared a central city by the Office of Management and Budget in June 1996.

I investigate regional variation in columns (6)-(9) and (15)-(18) of Table 6. Though the regressions presented above allow for sampling area fixed effects, the areas within a given region most likely share a degree of homogeneity so examining these differences may aid in understanding the poor price gap. Generally, prices are lowest for the poor in the Midwest. The top panel of the table examines the average price gap, showing a 26 and 10 percent discount in the Midwest and south, respectively. The second panel of the table presents the effects of regional variation on poor subgroup price differentials. The figures show that for poor (non-Hispanic) white neighborhoods discounts are highest in the Midwest (27.7 percent), followed by the northeast (17 percent). Poor Hispanic neighborhoods also receive the largest discounts in the Midwest.

6. Caveats

There are several caveats that should be kept in mind when interpreting the above results. First, zip codes may not be a good proxy for the neighborhood since zip codes are delineated by the U.S. Postal Service in accordance with efficient delivery of the mail. The boundaries are not intended to reflect the amenities and characteristics that may distinguish one neighborhood from another. A related criticism is the use of county level segregation measures. In general, aerial units used to measure segregation are arbitrary and indices calculated from different units will differ in their correlation and magnitude--a problem known as aggregation bias. Since zip codes are larger than census tracts (another proxy for neighborhood) in urban areas, my indices of segregation may be smaller because of less racial and ethnic concentration and homogeneity [Massey and Denton 1988]. As a result, my estimates of the net price differential across racial and ethnic neighborhood types may be a lower bound of the true range.

The second source of bias arises from unmodeled mobility. I identify the price effects using intra-area variation, but I do not address the question of mobility. If less mobile blacks choose to live in concentrated counties and mobility is positively correlated with price (which may occur because more mobile people value amenities) then my estimate of the net price differential may be downward biased. In this case, poor black neighborhoods may have higher prices than affluent white neighborhoods. Cross-neighborhood shopping may induce a related source of potential bias. Since consumers can theoretically shop anywhere, the relationship between neighborhood income and price may be weakened. One possible fix for this problem of measurement error in the poverty status variables is to use the average income of the store's patronizing consumers as the income measure. While the BLS sample frame represents where consumers shop, the information linking the income of the correspondent to the store patronized is not currently available.

The third source of bias arises from unmodeled product availability. As the BLS survey does not explicitly account for product breadth in its multi-level probability of selection technique, I cannot control for this source of variation in item prices. This is a potentially important omission because the lack of variety can be modeled as a price premium. Further, since smaller stores necessarily lack extensive variety and smaller stores are more likely to locate in poor and predominantly black and Hispanic neighborhoods, my net price differential may be downward biased. However, I believe that the full effect of this source of bias is mitigated by my inclusion of store quality characteristics since larger stores offering a mix of auxiliary services are more likely have large varieties of every product.

Finally, the analysis sample is comprised largely of perishable items for which quality differences may exist despite the characteristic controls. However, the sample composition does not appear to drive the main results as I have conducted the analysis in Table 5a across a mixture of items. The analysis shows that the relationship between the prices of fresh fruit and meat and income is not systematically different from that of the non-perishable items.

7. Conclusion: Price dispersion or price discrimination?

This analysis looks at price differences and attempts to explain the price gap between poor and affluent neighborhoods in terms of economic and non-economic factors by controlling for costs, quality, and consumer search. Although there are many ways to define the poor, I find that independent of classification, the most deprived neighborhoods in the U.S. do not face higher market prices for goods. In fact, I find that the poor face discounted net prices that can be as much as 6.1 percent lower than those faced by the more affluent. Further, the store heterogeneity results support the arguments of proponents for superstores, at least for homogenous items. Although I analyze only 5 items, the results likely extend to a variety of foods that are prepared at home by virtue of the BLS survey strategy.

The price gap appears to be most consistent with price dispersion generated by various costs to both the consumer and the firm. Quality differences and consumer search, in particular, go far in explaining price differences between stores both within and between different neighborhood types. Accounting for factors such as these are necessary to isolate the relationship between prices and neighborhood income. While price dispersion accounts for much of the observed variation in prices, it does not completely explain the price gap as significant discounts remain for some poor subgroups.

One possible explanation for the robust significant discounts is third-degree (classical) price discrimination. The results presented are consistent with food stores offering discounts to those consumers who may have greater price elasticities of demand.

I do not find strong evidence of Becker-type racial discrimination against segments of the poor. While poor (non-Hispanic) white and predominantly Hispanic neighborhoods have market prices considerably lower than those in affluent (non-Hispanic) white neighborhoods for some items, net prices in poor, predominantly black neighborhoods do not significantly differ. This result is robust to the definition of poor and to the item. The lack of a difference by race may reflect omitted variables (e.g., the race of the store owners, consumer mobility, etc.).

In sum, while I do not find evidence that prices are higher for the items investigated in this paper, I do find that costs are important in the discussion and such costs explain a significant portion of the price gap.

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9. Data Appendix

Commodities and Services Database (C&S)

The Commodities and Services Database (C&S) contains the prices collected by the Bureau of Labor Statistics (BLS) for use in the compilation of the Consumer Price Index (CPI). The CPI is designed to measure the (monthly) change in prices of goods and services purchased by typical urban American consumers. It is calculated by comparing the cost of a fixed set of goods and services at current prices with the cost of an identical market basket at prices prevailing during a reference period. Price data are collected from a survey of stores without regard to coupon use or special discounts (i.e. senior citizen and quantity discounts). However, the survey does collect sale prices when they are available to every consumer.

The BLS maintains price information at several levels of aggregation. See Appendix Figure 1 for a schematic diagram. Prices are available for eight major groups: food and beverages; housing; apparel; transportation; medical care; recreation; education and communication; and other goods and services. These groups represent the highest level of price aggregation. Within each major group items are arranged according to expenditure classes (e.g., cereal and cereal products, bakery products, etc.) in order to group like products and to allow imputation of price change for the CPI when actual prices are unavailable. Within each expenditure class are item strata (e.g., flour and prepared flour mixes, cereal, etc.), which are generally a group of products that are expected to have similar price movements (Lane (1996), MLR, p. 19). The lowest level of aggregation is entry-level items--the products surveyed in stores (e.g., flour, cereal, rice, etc.). The C&S Database contains price information for the 69 expenditure categories that comprise the 8 major groups, which in turn are divided into 207 item strata and 364 ELIs (BLS Handbook of Methods (1997), p. 178). Price data are collected monthly for the food and beverages major group and bimonthly for all other major groups.

The price survey samples 87 geographic areas referred to as primary sampling units (PSUs) which comprise most of the contiguous states, as well as Alaska and Hawaii (BLS Handbook of Methods (1997), p.177). Montana, North Dakota, and Wyoming are not sampled. The frame of outlet respondents is obtained from the Telephone Point-of-Purchase Survey (TPOPS), an unpublished supplemental survey conducted by the Bureau of the Census under contract with the BLS. The TPOPS questions qualified households about where they typically shop for a number of commodities and the amount they expend. Eligible households for the TPOPS include all civilian, non-institutional persons, including persons residing in boarding houses, housing facilities for students and workers, mobile home parks, permanent-type living quarters in hotels and motels, and staff residing in institutions (BLS Handbook of Methods (1997), p. 179). The probability of outlet selection for the price survey is proportional to consumer expenditures derived from the TPOPS. The unique item (i.e., brand, size, etc.) is chosen through disaggregation--a multistage probability sampling procedure in which all goods within an entry-level item category are given a probability for selection in proportion to their dollar sales in the store (U.S. Department of Labor, Consumer Price Index C&S Initiation Data Collection Manual, January 1998, Chapter 6, p. 1).

As a result of this sampling strategy, each item strata is surveyed in every PSU, but different unique items are selected in each store. Thus, the market basket differs across sampling units precluding the comparison of identical market basket prices in this study. I use the itemized specification list completed after disaggregation to create indicator variables for the hedonic regressions I compute.

Analysis Sample

The data used in this study are derived from the C&S Database for the food and beverages major group. The sample includes 19 expenditure categories, 65 item strata, and 92 entry-level items. Data were extracted for the period covering January 1998 to December 1998 for the food at home item strata. All prices are analyzed at the entry-level item level in this paper. The sample averages approximately 42,500 monthly price observations from 4,790 stores. The sample contains only the last nine monthly observations of round steak due to a coding error and subsequent archiving of the data. These omissions exclude 4,740 observations---less than 1 percent of the extracted sample.

I use several other criteria to limit the sample. First, I select only observations that are available for use in the final compilation of the CPI. This eliminates prices collected for evaluation purposes such as experimental indices, reducing the sample by 104,295 observations or 22 percent. Second, I eliminate price quotes that are flagged as "awaiting central office clearance," "temporarily unavailable to be priced in outlet," "out-of-season," "outlet status unknown," or "deletion of price quote pending" to insure price quotes are obtained from established outlets. This affects 12 observations. I further limit the sample to outlets for which food may be purchased for home preparation and consumption. This criterion excludes food service establishments such as restaurants, cafeterias, and food vending machines, effecting 30,327 observations. Overall, these combined criteria reduce the initial sample size by 134,544 observations or approximately 30 percent. In this paper I focus on the following items only: flour, white bread, ground beef, pork chops, whole chicken, eggs, milk, bananas, oranges, potatoes, lettuce, salad, and non-carbonated juice. My usable sample from the BLS consists of 63,557 observations from 2,181 outlets across 1,813 zip codes in 43 states. Survey data are collected from outlets and respondents on a voluntary basis and are confidential. In adherence to this confidentially, I do not reveal outlet names and product brands in this analysis.

Marketing Data

Because the C&S Database contains only cursory data on outlets, specifically name, address, and phone number, I supplement it with more extensive data from SPECTRA, Inc., a private marketing firm in Illinois. The SPECTRA sample consists of 19,836 observations on supermarkets, grocery stores, and large-scale discounters from every state, except Alaska, Delaware, Kansas, New Mexico, Oklahoma, Rhode Island, and South Dakota. These data are matched to the C&S Database sample using a statistical matching technique provided by AUTOMATCH software. AUTOMATCH matches using a probabilistic algorithm. The file match utilized in this study is accomplished in four passes through the data, with the first pass matching on zip code and the second matching on the soundex (a four-digit alphanumeric code that represents the phonetic pronunciation) of the parsed outlet name. The third pass matches on the soundex of the parsed street name of the outlet, while the final pass matches on a combination of the dwelling number and state of the outlet. In this manner 1721 or 79 percent of BLS outlets were matched. A dummy variable equal to 1 if the BLS outlet lacks characteristic data is included in all regressions using the SPECTRA data. Missing data are imputed utilizing a hot-deck procedure.

I derive measures of competition from the number of outlets in a zip code using another database obtained to InfoUsa, Inc., a marketing company in Nebraska. An outlet is defined as operating in a "competitive" environment if more than 5 outlets operate in its zip code. It is defined as being an oligopolist if it does not operate in a monopoly, duopoly, or competitive environment.

Shopper density is defined as the total population per zip code divided by the number of stores in a zip code using the InfoUsa sample.

Segregation indices

Demographic data for this project were collected from a variety of sources. Demographic data by zip code were obtained from the 1990 Census utilizing Summary Tape File 3B. Segregation indices were calculated using zip code data aggregated to the county level. The dissimilarity and isolation indices are based on formulations outlined in Massey and Denton [1983]. The dissimilarity index is calculated as:

$$D = \sum_{z=1}^{Z} \frac{t_z |p_z - P|}{2TP(1-P)}, \tag{A1}$$

where t_z and p_z are the total population and subgroup proportion in zip code *z*, and *T* and *P* are the total population and subgroup proportion in the county. The index varies between 0 and 1 and measures the proportion of subgroup members that would have to change their area of residence to ensure an even distribution of groups in the county. Index values above 0.6 are considered large [Massey and Denton 1993].

The isolation index measures the likelihood that subgroup members come into contact only with other subgroup members. The index is calculated as:

$$_xP_x^* = \sum_{z=1}^{Z} \frac{(x_z/X)}{(x_z/t_z)}, \tag{A2}$$

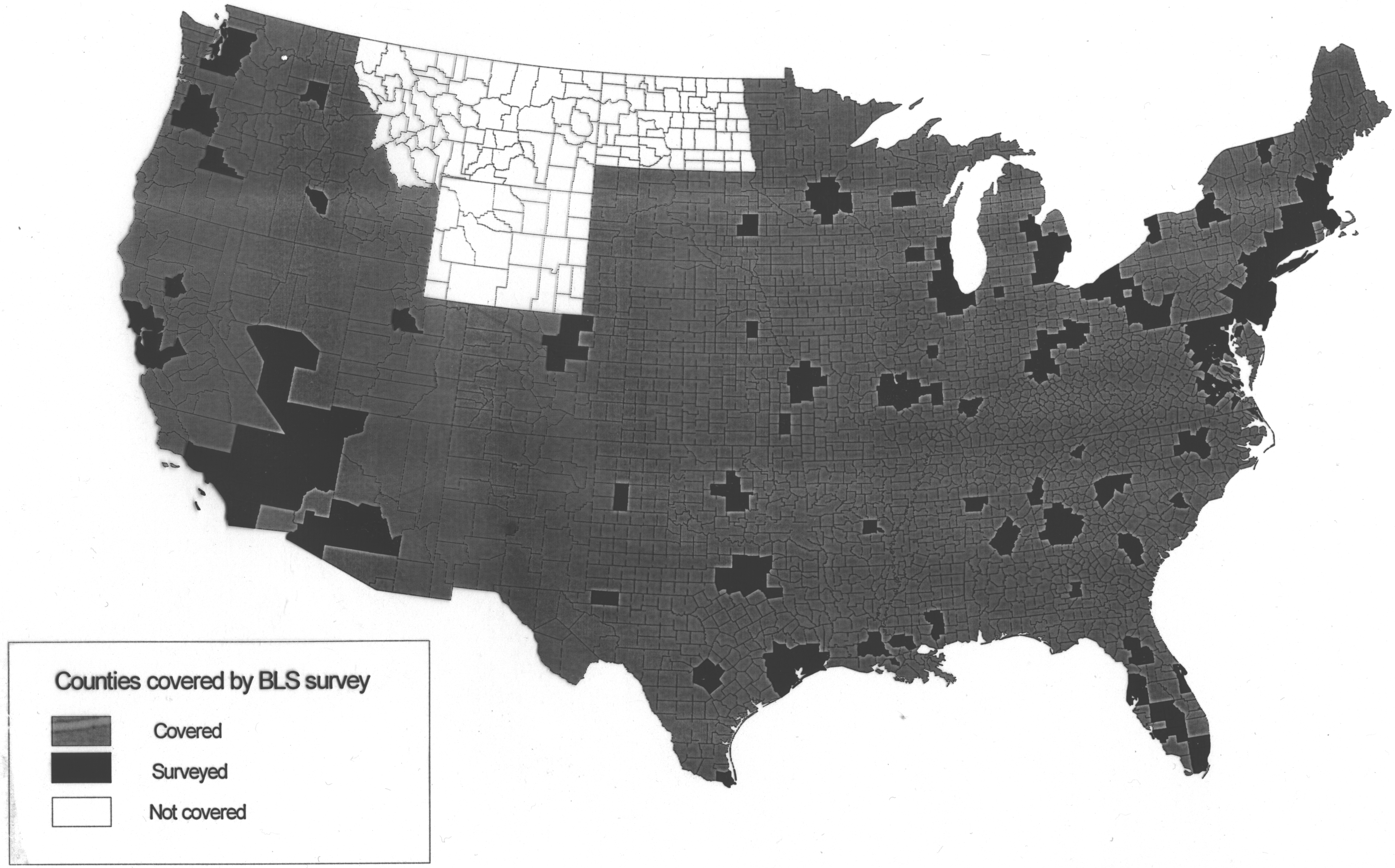
where x_z is the count of subgroup members in zip code *z* and *X* is the total number of sugroup members county-wide. This index also varies from 0 to 1, with higher index values indicating greater isolation from the majority population. While the indices appear very similar they are conceptually distinct because it is possible to simultaneously have a low index of dissimilarity and a high index of isolation. This would occur if the subgroup members were a relatively large proportion of the zip code, but experience very little contact with majority members (Blau, 1977).

The indices used in this paper may be fairly low due to my choice of the zip code as the aerial unit. The spatial unit of observation largely determines the magnitude of the segregation index. This is because smaller aerial units (e.g., census tracts) may be more homogenous, which generally yields higher indices of segregation.

Demographic Data

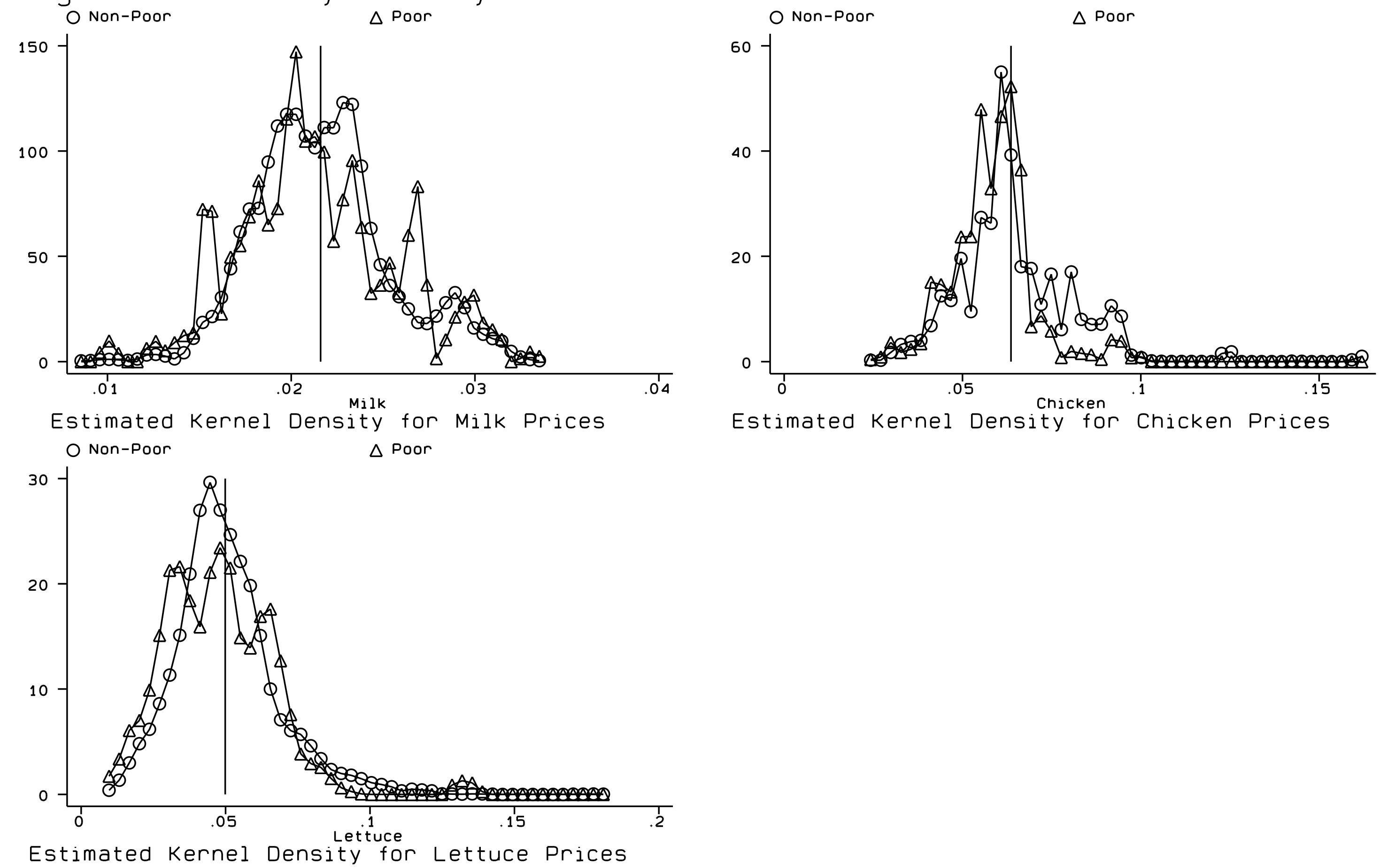
Expenditure shares are taken from Table 2 of the Consumer Expenditure Survey (1997). Information on central city status was obtained from U.S. Census Bureau (http:// www.census.gov/ geo). Data on land area by zip code were obtained from the MABLE/Geocorr V2.5 geographic correspondence engine (http://www.census.gov/plue/geocorr). Agency-level crime information by zip code was compiled from the Uniform Crime Reports (ICPSR Study No. 9028) provided by the U.S. Department of Justice, Federal Bureau of Investigation and data files provided from Marianne Bertrand and Brian Doyle of Princeton University. Crime counts are assigned to neighborhoods by zip code. All demographic variables are matched to the price sample by zip code.

BLS Primary Sampling Units (PSUs) in 1998



Source: Monthly Labor Review, Appendix 2, December 1996.

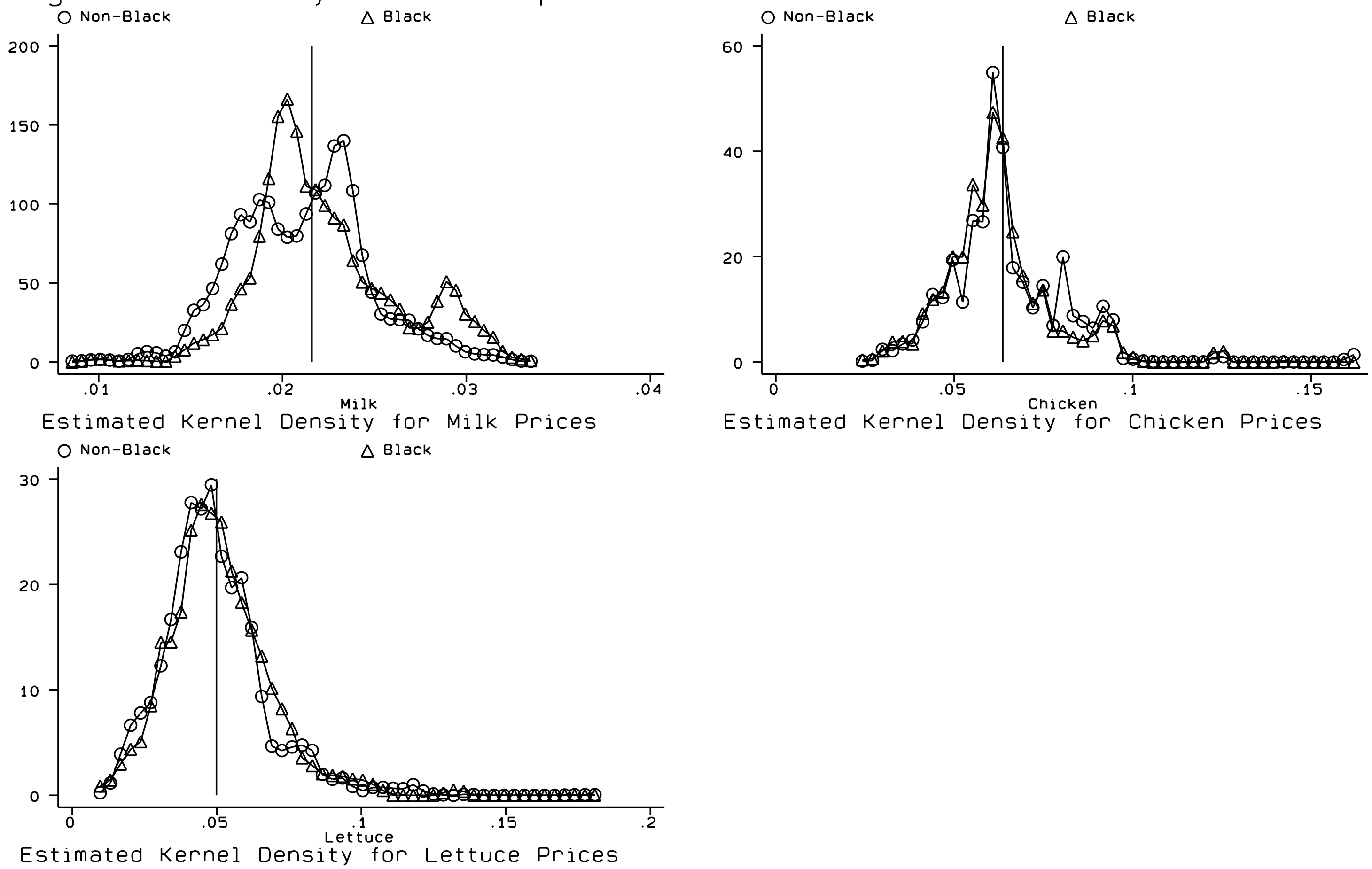
Figure 1 - Distribution of Unit Prices of Selected Homogenous Items by Poverty Class



Unit Price (Price Per Ounce Including Tax)

Distribution Comparisons by Poverty Class.

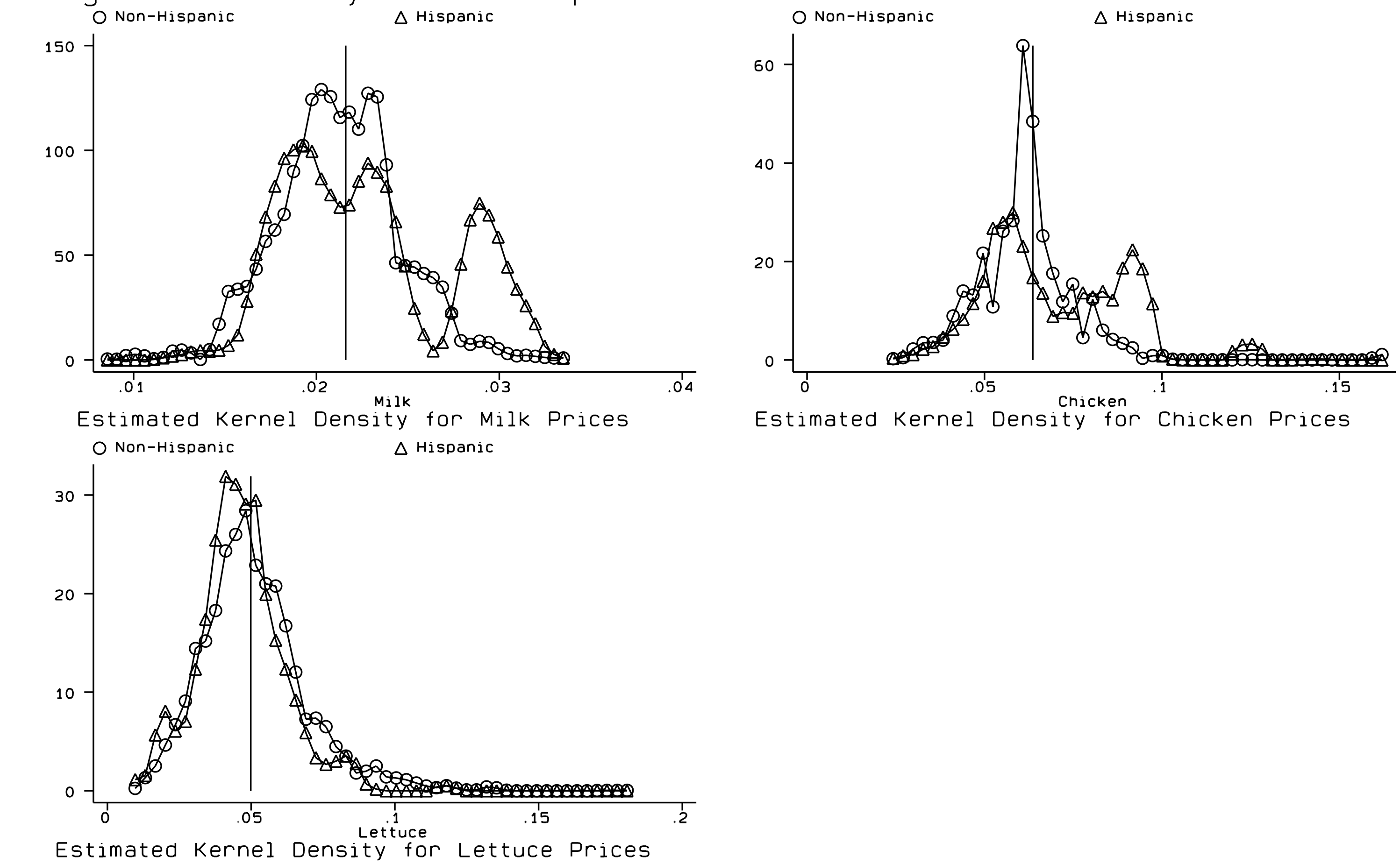
Figure 2 - Distribution of Unit Prices of Selected Homogenous Items by Racial Composition



Unit Price (Price Per Ounce Including Tax)

Distribution Comparisons by Racial Composition.

Figure 3 - Distribution of Unit Prices of Selected Homogenous Items by Ethnic Composition



Unit Price (Price Per Ounce Including Tax)

Distribution Comparisons by Ethnic Composition.

Appendix Figure 1: Example of CPI Item Structure

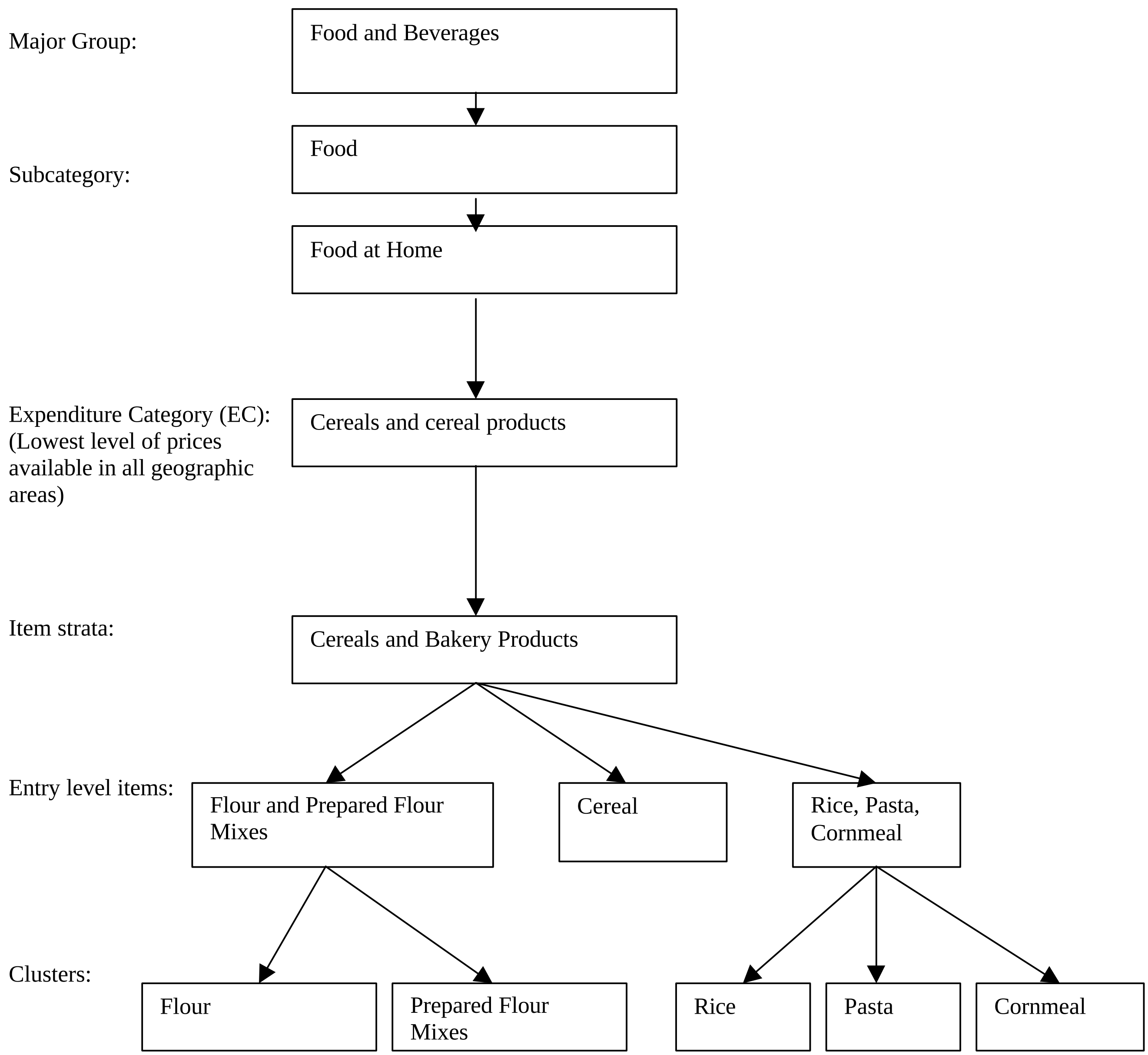


Table 1. Descriptive Statistics of independent variables: Comparison of BLS sample means of search costs, neighborhood demographics, store costs, and market structure to all neighborhoods in the U.S., Spectra-available data subsample, and BLS sample by poverty status

Variables	All neighborhoods in the U.S.[1] (1)	All BLS sample outlets (2)	BLS sample outlets for which store characteristics are available (3)	BLS Sample outlets located in neighborhoods where the proportion in poverty exceeds 20 percent (poor) (4)	BLS Sample outlets located in neighborhoods where the proportion in poverty is less than 20 percent (non-poor) (5)
Proportion of population below the poverty level	0.132	0.123	0.125	0.312	0.089
	[0.099]	[0.099]	[0.100]	[0.086]	[0.050]
Proportion of counties with Black index of dissimilarity>0.6 and Index of Isolation>0.4	0.019	0.320	0.361	0.400	0.305
	[0.136]	[0.466]	[0.480]	[0.490]	[0.461]
Proportion of counties with Black index of Isolation>0.3	0.164	0.507	0.563	0.634	0.485
	[0.370]	[0.500]	[0.496]	[0.482]	[0.500]
Proportion of counties with Hispanic index of dissimilarity>0.6 and Index of Isolation>0.	0.009	0.210	0.223	0.312	0.192
	[0.093]	[0.407]	[0.416]	[0.463]	[0.394]
Proportion of counties with Hispanic index of Isolation>0.3	0.052	0.308	0.323	0.530	0.268
	[0.223]	[0.462]	[0.468]	[0.499]	[0.443]
Search					
Proportion of households without a vehicle	0.113	0.135	0.145	0.300	0.105
	[0.126]	[0.156]	[0.166]	[0.216]	[0.121]
Number of stores in neighborhood (per square mile)*Poverty rate	n/a[3]	1.074	1.150	2.877	0.748
		[1.298]	[1.362]	[1.923]	[0.793]
Proportion of population completing up to grade 12, no diploma	0.250	0.238	0.243	0.402	0.209
	[0.127]	[0.128]	[0.130]	[0.151]	[0.097]
Proportion of population obtaining high school diploma, including GED	0.302	0.279	0.279	0.249	0.284
	[0.082]	[0.074]	[0.074]	[0.071]	[0.073]
Proportion of population completing some college, no degree	0.206	0.215	0.212	0.190	0.220
	[0.064]	[0.060]	[0.057]	[0.094]	[0.050]
Proportion of population with associate, bachelor, or graduate/professional degree	0.241	0.267	0.266	0.159	0.287
	[0.127]	[0.129]	[0.130]	[0.096]	[0.124]
Neighborhood demographics					
Proportion of unoccupied housing units	0.087	0.066	0.065	0.100	0.061
	[0.076]	[0.046]	[0.044]	[0.051]	[0.042]
Population density (per square mile, per zip code, ÷ 1,000)	3.938	7.135	8.063	13.156	6.048
	[9.436]	[14.642]	[15.976]	[19.652]	[13.253]
Proportion located in a central city	0.381	0.504	0.500	0.753	0.460
	[0.486]	[0.500]	[0.500]	[0.431]	[0.498]
Proportion non-Hispanic White	0.756	0.697	0.683	0.348	0.761
	[0.262]	[0.279]	[0.290]	[0.293]	[0.225]
Proportion non-hispanic Black	0.119	0.125	0.134	0.317	0.090
	[0.198]	[0.199]	[0.209]	[0.308]	[0.146]
Proportion of Hispanic origin	0.089	0.124	0.129	0.296	0.093
	[0.161]	[0.192]	[0.197]	[0.315]	[0.139]
Crime					
Total property crime per capita	n/a	0.072	0.071	0.126	0.062
		[0.144]	[0.138]	[0.286]	[0.096]
Total crime per capita	n/a	0.079	0.078	0.140	0.068
		[0.166]	[0.161]	[0.331]	[0.109]
Operating Costs					
Number of checkouts	8.700	9.822	9.770	8.739	10.017
	----	[4.531]	[5.011]	[4.398]	[4.527]
Number of full-time employees	n/a	39.862	38.814	34.916	40.755
		[21.935]	[24.142]	[23.365]	[21.546]
Number of part-time employees	n/a	56.279	53.113	46.625	58.022
		[28.758]	[30.942]	[32.390]	[27.697]

-- (continued) --

(Table 1, continued)

Variables	All neighborhoods in the U.S.[1] (1)	All BLS sample outlets (2)	BLS sample outlets for which store characteristics are available (3)	BLS Sample outlets located in neighborhoods where the proportion in poverty exceeds 20 percent (poor) (4)	BLS Sample outlets located in neighborhoods where the proportion in poverty is less than 20 percent (non-poor) (5)
Proportion chain stores	0.621	0.722	0.743	0.593	0.746
	----	[0.448]	[0.437]	[0.491]	[0.436]
Proportion with scanning equipment	n/a	0.777	0.774	0.737	0.784
		[0.378]	[0.418]	[0.411]	[0.371]
Discretionary costs					
Proportion using circulars	0.899	0.855	0.857	0.863	0.854
	----	[0.295]	[0.327]	[0.288]	[0.297]
Proportion using in-store demonstrations	0.664	0.624	0.617	0.601	0.628
	----	[0.416]	[0.460]	[0.425]	[0.414]
Proportion doubling coupons	0.437	0.367	0.367	0.273	0.383
	----	[0.412]	[0.456]	[0.374]	[0.417]
Proportion with frequent shopper program	0.215	0.213	0.213	0.173	0.220
	----	[0.353]	[0.390]	[0.321]	[0.358]
Proportion using in-store coupons	0.829	0.717	0.716	0.689	0.722
	----	[0.383]	[0.424]	[0.401]	[0.380]
Quality					
Proportion with from-scratch bakery	0.466	0.692	0.688	0.564	0.715
	----	[0.394]	[0.436]	[0.436]	[0.381]
Proportion with delicatessen	0.772	0.851	0.848	0.740	0.872
	----	[0.302]	[0.334]	[0.398]	[0.277]
Proportion with butcher department	0.604	0.719	0.721	0.706	0.722
	----	[0.380]	[0.421]	[0.391]	[0.378]
Proportion with seafood department	0.433	0.662	0.662	0.522	0.687
	----	[0.403]	[0.445]	[0.437]	[0.391]
Proportion with pharmacy	0.264	0.379	0.374	0.279	0.397
	----	[0.420]	[0.465]	[0.385]	[0.424]
Proportion with full-service bank	0.221	0.226	0.225	0.197	0.231
	----	[0.263]	[0.291]	[0.190]	[0.274]
Proportion with automatic teller machine	0.618	0.701	0.704	0.589	0.722
	----	[0.387]	[0.428]	[0.430]	[0.375]
Proportion offering check cashing	0.614	0.585	0.588	0.547	0.591
services	----	[0.421]	[0.466]	[0.431]	[0.419]
Proportion with warehouse aisles	0.160	0.122	0.125	0.085	0.129
	----	[0.266]	[0.294]	[0.218]	[0.273]
Market structure					
Number of stores per zip code	n/a	1.769	2.029	2.935	1.559
(per square mile)		[6.029]	[6.604]	[6.635]	[5.888]
Population per store ÷ 1,000)	n/a	6.753	6.566	6.304	6.834
		[6.077]	[5.985]	[4.622]	[6.300]
Grocery selling area	27.341	31.173	30.882	26.592	32.000
(in square feet, ÷ 1,000)	----	[15.013]	[16.595]	[16.896]	[14.494]
Yearly sales volume	$11.328	$11.659	$11.600	$10.630	$11.846
(in dollars, ÷ 1,000,000)	----	[10.423]	[11.530]	[9.507]	[10.570]
Market share (share of yearly	n/a	0.328	0.316	0.301	0.333
sales volume)		[0.225]	[0.247]	[0.221]	[0.225]
Number of observations	28619	2181	1728	308	1873

Note: Standard deviations are in brackets. Neighborhood refers to the postal zip code. Means are weighted by the total population in the zip code. The BLS does not survey Montana, North Dakota, and Wyoming, therefore these states are omitted from the above table. In addition, I do not have cost and quality data for stores in Arkansas, Delaware, Kansas, and Rhode Island. The number of observations in the BLS sample is the number of unique outlets. There are multiple outlets in a zip code.

[1]Average store characteristic data for the U.S. are taken from the *Supermarket Census* [Trade Dimensions 1998].

[2]Segregation indices are calculated at the county level. The figure reported for the U.S. is the average of segregation indices in 3,005 counties. Racial indices refer to non-Hispanic Blacks.

[3]Data not available.

Source: Author's calculations using the 1990 Census STF3B, Bureau of Labor Statistics survey data, the *Supermarket Census* [Trade Dimensions 1998], and data obtained from Spectra Marketing, Inc.

Table 2. Mean price differences of homogenous items by alternative definitions of poor

Group status definition:		One Gallon of Vitamin D fortified, whole milk (1)	Nonkosher, broiler/fryer whole chicken, per pound (2)	One-dozen, large, Grade A white eggs (3)	Loose Navel oranges, per pound (4)	Individually packaged Iceberg lettuce, per pound (5)
Proportion in 80th percentile of state poverty distribution	nonpoor:	2.768	1.029	1.107	0.814	0.795
		(0.044)	(0.018)	(0.026)	(0.023)	(0.017)
	poor:	2.779	0.963	0.982	0.766	0.811
		(0.062)	(0.018)	(0.039)	(0.075)	(0.043)
	poor-nonpoor:	0.011	-0.066	-0.125	-0.048	0.016
		[.886]	[.010]	[.009]	[.536]	[.725]
Proportion in 90th percentile of state poverty distribution	nonpoor:	2.777	1.027	1.088	0.824	0.798
		(0.040)	(0.017)	(0.024)	(0.022)	(0.017)
	poor:	2.624	0.934	1.013	0.679	0.798
		(0.101)	(0.019)	(0.069)	(0.124)	(0.047)
	poor-nonpoor:	-0.153	-0.093	-0.075	-0.145	0.000
		[.166]	[.000]	[.310]	[.252]	[.999]
First quintile of poverty rate	nonpoor:	2.788	1.016	1.123	0.847	0.852
		(0.109)	(0.035)	(0.039)	(0.039)	(0.023)
Second quintile of poverty rate	nonpoor:	2.789	1.048	1.104	0.813	0.787
		(0.074)	(0.042)	(0.037)	(0.042)	(0.034)
Third quintile of poverty rate	nonpoor:	2.749	1.036	1.087	0.862	0.747
		(0.071)	(0.033)	(0.072)	(0.053)	(0.034)
Fourth quintile of poverty rate	poor:	2.734	1.022	1.077	0.685	0.749
		(0.089)	(0.035)	(0.108)	(0.044)	(0.022)
Fifth quintile of poverty rate	poor:	2.779	0.963	0.982	0.766	0.811
		(0.062)	(0.018)	(0.039)	(0.075)	(0.043)
	poor(fourth quintile)-nonpoor(first quintile):	-0.054	0.006	-0.046	-0.162	-0.103
		[.705]	[.901]	[.689]	[.007]	[.001]
	poor(fifth quintile)-nonpoor(first quintile):	-0.009	-0.053	-0.141	-0.081	-0.041
		[.942]	[.176]	[.012]	[.344]	[.403]
Overall mean price		2.765	1.018	1.081	0.803	0.798
Standard deviation of overall mean price		1.783	0.821	0.909	1.211	0.532
Total number of observations		2176	2825	1634	2418	1117

Note: The unit of observation is the price including tax. Standard errors (robust to correlation of residuals within stores) are in parentheses. P-values are in brackets. Prices are weighted by the base-period quantity weight (see the *BLS Handbook of Methods*, chapter 17).
Source: Author's calculations using the Bureau of Labor Statistics price level data and 1990 Census STF 3B.

Table 3. Mean price differences of homogenous items by alternative definitions of neighborhood racial and ethnic composition

Group status definition:		One Gallon of Vitamin D fortified, whole milk (1)	Nonkosher, broiler/fryer whole chicken, per pound (2)	One-dozen, large, Grade A white eggs (3)	Loose Navel oranges, per pound (4)	Individually packaged Iceberg lettuce, per pound (5)
Black Index of dissimilarity>0.6 and Index of Isolation>0.3	predominately non-black	2.714	1.016	1.079	0.806	0.800
		(0.039)	(0.018)	(0.025)	(0.023)	(0.018)
	predominately black	2.923	1.024	1.087	0.794	0.796
		(0.087)	(0.033)	(0.051)	(0.069)	(0.032)
	black-nonblack difference:	0.209	0.008	0.008	-0.012	-0.004
		[.029]	[.817]	[.898]	[.873]	[.927]
Black Index of Isolation>0.3	predominately non-black	2.700	1.032	1.074	0.789	0.787
		(0.048)	(0.020)	(0.033)	(0.023)	(0.021)
	predominately black	2.846	0.997	1.088	0.818	0.811
		(0.060)	(0.022)	(0.032)	(0.044)	(0.024)
	black-nonblack difference:	0.156	-0.035	0.014	0.029	0.024
		[.042]	[.247]	[.754]	[.550]	[.450]
Hispanic Index of dissimilarity>0.4 and Index of Isolation>0.3	predominately non Hispanic	2.727	0.997	1.080	0.805	0.804
		(0.035)	(0.016)	(0.024)	(0.021)	(0.019)
	predominately Hispanic	2.983	1.136	1.095	0.793	0.774
		(0.131)	(0.038)	(0.059)	(0.102)	(0.025)
	Hispanic-non-Hispanic difference:	0.256	0.139	0.015	-0.012	-0.030
		[.061]	[.001]	[.809]	[.910]	[.335]
Hispanic Index of Isolation>0.3	predominately non Hispanic	2.716	0.984	1.080	0.805	0.816
		(0.036)	(0.014)	(0.025)	(0.023)	(0.019)
	predominately Hispanic	2.909	1.117	1.085	0.795	0.747
		(0.095)	(0.037)	(0.045)	(0.070)	(0.024)
	Hispanic-non-Hispanic difference:	0.193	0.133	0.005	-0.010	-0.069
		[.059]	[.001]	[.928]	[.899]	[.028]
Overall mean price		2.765	1.018	1.081	0.803	0.798
Standard deviation of overall mean price		1.783	0.821	0.909	1.211	0.532
Total number of observations		2176	2825	1634	2418	1117

Note: The unit of observation is the price including tax. Segregation indices are calculated at the county level. The race indices are defined for non-Hispanic Blacks. Standard errors (robust to correlation of residuals within stores) are in parentheses. P-values are in brackets. Prices are weighted by the base-period quantity weight (see the *BLS Handbook of Methods*, chapter 17).

Source: Author's calculations using the Bureau of Labor Statistics price level data and 1990 Census STF 3B.

Table 4. FE estimates of the effect of sequentially controlling for factors related to price dispersion on the unit price (price per ounce plus tax) differential for the poor

	Overall								
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Poor	-0.067	-0.074	-0.092	-0.093	-0.090	-0.079	-0.081	-0.064	-0.061
	(0.024)	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)	(0.035)	(0.034)
Other covariates included?	no	yes	yes	yes	yes	yes	yes	yes	yes
P-values of joint-test of the explanatory contribution of covariate groups:									
Neighborhood demographics	----	----	0.028	0.029	0.033	0.027	0.013	0.022	0.038
Crime variables	----	----	----	0.890	0.694	0.354	0.379	0.856	0.644
Operating costs	----	----	----	----	0.082	0.652	0.911	0.918	0.817
Discretionary costs	----	----	----	----	----	0.023	0.047	0.049	0.068
Market structure variables	----	----	----	----	----	----	0.052	0.041	0.085
Search variables	----	----	----	----	----	----	----	0.006	0.018
Quality variables	----	----	----	----	----	----	----	----	0.004
Adjusted R^2	0.967	0.977	0.978	0.978	0.978	0.978	0.978	0.979	0.979

	Subgroups								
Variables	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Poor, predominately white,	-0.092	-0.096	-0.099	-0.102	-0.113	-0.106	-0.105	-0.070	-0.077
non-Hispanic neighborhoods	(0.034)	(0.035)	(0.036)	(0.036)	(0.037)	(0.036)	(0.035)	(0.040)	(0.039)
Poor, predominately black	0.046	0.045	0.026	0.025	0.030	0.040	0.037	0.060	0.057
neighborhoods[1]	(0.039)	(0.043)	(0.042)	(0.042)	(0.041)	(0.042)	(0.042)	(0.053)	(0.053)
Poor, predominately Hispanic	-0.217	-0.224	-0.219	-0.225	-0.245	-0.236	-0.231	-0.185	-0.197
neighborhoods[1]	(0.065)	(0.065)	(0.064)	(0.063)	(0.062)	(0.061)	(0.061)	(0.068)	(0.068)
Other covariates included?	no	yes	yes	yes	yes	yes	yes	yes	yes
P-values of joint-test of the explanatory contribution of covariate groups:									
Neighborhood demographics	----	----	0.086	0.074	0.119	0.105	0.062	0.065	0.113
Crime variables	----	----	----	0.567	0.340	0.167	0.217	0.505	0.362
Operating costs	----	----	----	----	0.063	0.598	0.940	0.946	0.860
Discretionary costs	----	----	----	----	----	0.030	0.054	0.047	0.061
Market structure variables	----	----	----	----	----	----	0.046	0.052	0.090
Search variables	----	----	----	----	----	----	----	0.012	0.034
Quality variables	----	----	----	----	----	----	----	----	0.006
Adjusted R^2	0.972	0.978	0.978	0.978	0.978	0.978	0.979	0.979	0.979

Note: The dependent variable is the logarithm of the unit price plus tax (price per ounce). Sample size is 10,170. All regressions include an intercept, item dummies, and local area fixed-effects. The other covariates are product size, a dummy variable indicating a sale price, and month dummies. Prices are weighted by the base-period quantity weight (see the *BLS Handbook of Methods*, chapter 17). Standard errors (robust to the correlation of residuals within stores) are in parentheses. The specific variables included in each category are listed in Table 1. The neighborhood demographics category excludes the race/ethnicity variables.

[1]The coefficients reported are the sum of the poor and race/ethnicity main effects and interaction.

Source: Author's calculations using the 1990 Census STF3B, Spectra, Inc. data on store characteristics, InfoUSA, Inc. data on market structure, and Bureau of Labor Statistics price level data.

Table 5a. Estimates accounting for between-item dispersion on the calculation of the price differential between poor and affluent neighborhoods (neighborhood income measured by median household income)

	One Gallon of Vitamin D fortified, whole milk		Nonkosher, broiler/fryer whole chicken		One-dozen, large, Grade A white eggs		Loose Navel oranges		Individually packaged Iceberg lettuce	
	Neighborhoods where the proportion in poverty exceeds 20 percent (poor)									
Neighborhood income measure:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Median household income	-0.115	0.251	-0.040	-0.332	-0.052	0.234	-0.014	0.604	0.151	1.239
(÷ 10,000)	(0.071)	(0.001)	(0.054)	(0.014)	(0.080)	(0.002)	(0.317)	(0.028)	(0.243)	(0.024)
Other covariates included?	no	yes	no	yes	no	yes	no	yes	no	yes
Number of observations	393	393	492	492	224	224	404	404	167	167
Adjusted R^2	0.108	0.778	0.290	0.821	0.051	0.865	0.235	0.809	0.344	#REF!
	Neighborhoods where the proportion in poverty is less than 20 percent (affluent)									
Neighborhood income measure:	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Median household income	0.016	0.008	0.021	-0.067	0.086	0.092	0.020	-0.004	0.059	0.006
(÷ 10,000)	(0.014)	(0.030)	(0.014)	(0.024)	(0.014)	(0.046)	(0.016)	(0.038)	(0.020)	(0.005)
Other covariates included?	no	yes	no	yes	no	yes	no	yes	no	yes
Number of observations	1783	1783	2333	2333	1410	1410	2014	2014	950	950
Adjusted R^2	0.172	0.796	0.255	0.714	0.310	0.785	0.454	0.624	0.368	0.709

Budget share weighted-average of price differentials (β-bar):

	Without covariates		With covariates:	
β-bar(affluent):	0.033	(0.007)	-0.008	(0.013)
β-bar(poor):	-0.006	(0.090)	0.427	(0.009)
β-bar(affluent) - β-bar(poor):	0.039	(0.090)	-0.435	(0.015)

Note: The dependent variable is the logarithm of the unit price plus tax (price per ounce). All regressions include an intercept, a dummy variable indicating a sale price, and month dummies. The other covariates include the neighborhood, crime, operating and discretionary cost, market structure, search, and quality covariates indicated in Table 1 (excluding the race variables from the neighborhood demographics category), dummies for store format, regional dummies, and local-area fixed effects. The top panel shows the coefficients for the poor neighborhoods in the sample, while the middle panel shows the coefficients for the affluent neighborhoods. The bottom panel shows the expenditure-share weighted average for the column coefficients. Each weighted average is calculated using the expenditure share for the poor. Prices are weighted by the base-period quantity weight (see the *BLS Handbook of Methods* , chapter 17). Standard errors (robust to the correlation of residuals within stores) are in parentheses.

Source: Author’s calculations using the 1990 Census STF3B, Spectra, Inc. data on store characteristics, and Bureau of Labor Statistics price level data.

Table 5b. Estimates accounting for within-item dispersion on the calculation of the price differential between predominately Black and non-Black neighborhoods (neighborhood income measured by median household income)

	One Gallon of Vitamin D fortified, whole milk		Nonkosher, broiler/fryer whole chicken		One-dozen, large, Grade A white eggs		Loose Navel oranges		Individually packaged Iceberg lettuce	
	Neighborhoods located in counties where the Black Index of Isolation >0.3 (predominantly black)									
Neighborhood income measure:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Median household income	0.007	0.013	0.012	-0.099	0.027	0.041	0.082	-0.040	0.020	0.025
(÷ 10,000)	(0.018)	(0.069)	(0.010)	(0.043)	(0.020)	(0.070)	(0.048)	(0.046)	(0.027)	(0.008)
Other covariates included?	no	yes	no	yes	no	yes	no	yes	no	yes
Number of observations	970	970	1140	1140	839	839	998	998	450	450
Adjusted R^2	0.131	0.809	0.310	0.769	0.143	0.838	0.367	0.728	0.454	0.695
	Neighborhoods located in counties where the Black Index of Isolation <=0.3 (non-black)									
Neighborhood income measure:	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Median household income	0.022	0.056	0.057	-0.014	0.098	0.018	0.023	-0.082	0.087	-0.012
(÷ 10,000)	(0.015)	(0.052)	(0.016)	(0.020)	(0.015)	(0.015)	(0.019)	(0.065)	(0.017)	(0.010)
Other covariates included?	no	yes	no	yes	no	yes	no	yes	no	yes
Number of observations	1206	1206	1685	1685	795	795	1420	1420	667	667
Adjusted R^2	0.175	0.878	0.259	0.768	0.432	0.851	0.444	0.652	0.392	0.680

Budget share weighted-average of price differentials (β-bar):

	Without covariates		With covariates:	
β-bar(black):	0.031	(0.013)	-0.007	(0.021)
β-bar(non-black):	0.050	(0.007)	-0.014	(0.019)
β-bar(black)-β-bar(non-black):	-0.019	(0.015)	0.007	(0.028)

Note: The dependent variable is the logarithm of the unit price plus tax (price per ounce). All regressions include an intercept, a dummy variable indicating a sale price, and month dummies. The other covariates include the neighborhood, crime, operating and discretionary cost, market structure, search, and quality covariates indicated in Table 1 (excluding the race variables from the neighborhood demographics category), local area fixed effects, dummies for store format, and local-areal dummies. Prices are weighted by the base-period quantity weight (see the BLS Handbook of Methods, chapter 17). Standard errors (robust to the correlation of residuals within stores) are in parentheses. The top panel shows the coefficients for the predominantly black neighborhoods in the sample, while the middle panel shows the coefficients for the non-black neighborhoods. The bottom panel shows the expenditure share weighted average of the column coefficients. Each weighted average is calculated using the average expenditure share across income groups.

Source: Author's calculations using the 1990 Census STF3B, Spectra, Inc. data on store characteristics, and Bureau of Labor Statistics price level data.

Table 5c. Estimates accounting for within-item dispersion on the calculation of the price differential between predominately Hispanic and non-Hispanic neighborhoods (neighborhood income measured by median household income)

	One Gallon of Vitamin D fortified, whole milk		Nonkosher, broiler/fryer whole chicken		One-dozen, large, Grade A white eggs		Loose Navel oranges		Individually packaged Iceberg lettuce	
	Neighborhoods located in counties where the Hispanic Index of Isolation >0.3 (predominantly Hispanic)									
Neighborhood income measure:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Median household income	0.031	-0.029	0.065	-0.191	-0.004	0.041	0.201	-0.026	0.042	0.094
(÷ 10,000)	(0.024)	(0.023)	(0.026)	(0.038)	(0.032)	(0.003)	(0.057)	(0.077)	(0.042)	(0.012)
Other covariates included?	no	yes	no	yes	no	yes	no	yes	no	yes
Number of observations	445	445	687	687	192	192	521	521	232	232
Adjusted R^2	0.130	0.884	0.312	0.825	0.090	0.793	0.536	0.822	0.414	0.585
	Neighborhoods located in counties where the Hispanic Index of Isolation <=0.3 (non-Hispanic)									
Neighborhood income measure:	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Median household income	0.003	-0.005	0.019	0.013	0.077	0.173	0.018	0.044	0.057	0.004
(÷ 10,000)	(0.012)	(0.017)	(0.010)	(0.022)	(0.013)	(0.035)	(0.022)	(0.039)	(0.015)	(0.005)
Other covariates included?	no	yes	no	yes	no	yes	no	yes	no	yes
Number of observations	1731	1731	2138	2138	1442	1442	1897	1897	885	885
Adjusted R^2	0.160	0.836	0.270	0.727	0.303	0.808	0.389	0.587	0.388	0.719
Budget share weighted-average of price differentials (β-bar):										
	Without covariates			With covariates:						
β-bar(Hispanic):	0.082	(0.018)		-0.034	(0.020)					
β-bar(non-Hispanic):	0.027	(0.007)		0.033	(0.011)					
β-bar(Hispanic)-β-bar(non-Hispanic):	0.055	(0.019)		-0.067	(0.023)					

Note: The dependent variable is the logarithm of the unit price plus tax (price per ounce). All regressions include an intercept. The other covariates include a dummy variable indicating a sale price, and month dummies, as well as the neighborhood, crime, operating and discretionary cost, market structure, search, and quality covariates indicated in Table 1 (excluding the race variables from the neighborhood demographics category), local area fixed effects, and dummies for store format. The top panel shows the coefficients for the predominantly Hispanic neighborhoods in the sample, while the middle panel shows the coefficients for the non-Hispanic neighborhoods. The bottom panel shows the expenditure share weighted average of the column coefficients. Each weighted average is calculated using the average expenditure share across income groups. Prices are weighted by the base-period quantity weight (see the *BLS Handbook of Methods*, chapter 17). Standard errors (robust to the correlation of residuals within stores) are in parentheses.

Source: Author's calculations using the 1990 Census STF3B, Spectra, Inc. data on store characteristics, and Bureau of Labor Statistics price level data.

Table 6. Investigating the effect of store type, central city status, and regional variation on FE estimates of the poor price gap

	Store type[1]			Central city status		Region			
	Superstore	Conventional supermarket	Store format unknown	Central city	Suburb	Northeast	Midwest	South	West
	Overall								
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Poor neighborhoods	-0.262	-0.054	-0.116	-0.054	-0.151	-0.107	-0.305	-0.103	-0.103
	(0.055)	(0.041)	(0.061)	(0.045)	(0.087)	(0.061)	(0.091)	(0.041)	(0.101)
Number of observations	3794	2997	2985	4967	5203	2152	2083	3582	2353
Adjusted R^2	0.986	0.989	0.973	0.981	0.982	0.988	#REF!	#REF!	#REF!
	Subgroups								
Variables	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Poor, predominately white,	-0.352	-0.008	-0.039	-0.096	-0.100	-0.187	-0.325	-0.108	-0.046
non-Hispanic neighborhoods	(0.065)	(0.048)	(0.077)	(0.054)	(0.073)	(0.071)	(0.098)	(0.057)	(0.091)
Poor, predominately black	-0.192	0.086	-0.094	0.136	-0.081	-0.036	-0.002	-0.063	-0.281
neighborhoods[2]	(0.074)	(0.076)	(0.093)	(0.094)	(0.090)	(0.124)	(0.147)	(0.056)	(0.258)
Poor, predominately Hispanic	-0.242	-0.140	-0.265	-0.093	-0.422	-0.173	-0.602	-0.156	0.101
neighborhoods[2]	(0.088)	(0.093)	(0.177)	(0.092)	(0.180)	(0.145)	(0.158)	(0.097)	(0.146)
Number of observations	3794	2997	2985	4967	5203	2152	2083	3582	2353
Adjusted R^2	0.986	0.985	0.979	0.986	0.982	0.988	#REF!	#REF!	#REF!

Note: The dependent variable is the logarithm of the unit price plus tax (price per ounce). All regressions include product size, a dummy variable indicating a sale price, and month dummies, as well as the neighborhood, crime, operating and discretionary cost, market structure, search, and quality covariates indicated in Table 1 (excluding the race variables from the neighborhood demographics category), and local area fixed-effects. Prices are weighted by the base-period quantity weight (see the *BLS Handbook of Methods*, chapter 17). Standard errors (robust to the correlation of residuals within stores) are in parentheses.

[1]A superstore is a supermarket with at least 30,000 square feet and annual sales in excess of $12 million, offering specialty departments and extensive services. Store type is based on data obtained from Spectra Marketing, Inc.

[2]The coefficients reported are the sum of the poor and race/ethnicity main effects and interaction.

Source: Author's calculations using the 1990 Census STF3B, Spectra, Inc. data on store characteristics, and Bureau of Labor Statistics price level data.

Appendix Table 1. Descriptive Statistics: Comparison of BLS sample means of search costs, neighborhood demographics, store costs, and market structure to the Spectra sample of stores

Variables	Spectra sample	BLS sample outlets
Search		
Proportion of households without a vehicle	0.208 [0.220]	0.135 [0.156]
Number of stores in neighborhood (per square mile)*Poverty rate	1.930 [2.545]	1.074 [1.298]
Proportion of population completing up to grade 12, no diploma	0.272 [0.144]	0.238 [0.128]
Proportion of population obtaining high school diploma, including GED	0.273 [0.074]	0.279 [0.074]
Proportion of population completing some college, no degree	0.201 [0.057]	0.215 [0.060]
Proportion of population with associate, bachelor, or graduate/professional degree	0.254 [0.141]	0.267 [0.129]
Neighborhood demographics		
Proportion of unoccupied housing units	0.071 [0.046]	0.066 [0.046]
Population density (per square mile, per zip code, ÷ 1,000)	12.934 [22.222]	7.135 [14.642]
Proportion located in a central city	0.513 [0.500]	0.504 [0.500]
Proportion non-Hispanic White	0.613 [0.318]	0.697 [0.279]
Proportion non-Hispanic Black	0.179 [0.250]	0.125 [0.199]
Proportion of Hispanic origin	0.157 [0.210]	0.124 [0.192]
Crime		
Total property crime per capita	0.139 [0.433]	0.072 [0.144]
Total crime per capita	0.159 [0.508]	0.079 [0.166]
Operating costs		
Number of checkouts	6.985 [4.784]	9.822 [4.531]
Number of full-time employees	24.804 [22.117]	39.862 [21.935]
Number of part-time employees	32.077 [29.725]	56.279 [28.758]
Proportion chain stores	0.652 [0.269]	0.722 [0.448]
Proportion with scanning equipment	0.484 [0.500]	0.777 [0.378]

-- (continued) --

(Appendix Table 1, continued)

Variables	Spectra sample	BLS sample outlets
<u>Discretionary costs</u>		
Proportion using circulars	0.812	0.855
	[0.309]	[0.295]
Proportion using in-store demonstrations	0.555	0.624
	[0.394]	[0.416]
Proportion doubling coupons	0.370	0.367
	[0.380]	[0.412]
Proportion with frequent shopper program	0.179	0.213
	[0.304]	[0.353]
Proportion using in-store coupons	0.640	0.717
	[0.380]	[0.383]
<u>Quality</u>		
Proportion with from-scratch bakery	0.573	0.692
	[0.392]	[0.394]
Proportion with delicatessen	0.783	0.851
	[0.330]	[0.302]
Proportion with butcher department	0.632	0.719
	[0.381]	[0.380]
Proportion with seafood department	0.557	0.662
	[0.393]	[0.403]
Proportion with pharmacy	0.297	0.379
	[0.382]	[0.420]
Proportion with full-service bank	0.173	0.226
	[0.208]	[0.263]
Proportion with automatic teller machine	0.596	0.701
	[0.388]	[0.387]
Proportion offering check cashing services	0.531	0.585
	[0.394]	[0.421]
Proportion with warehouse aisles	0.121	0.122
	[0.248]	[0.266]
<u>Market structure</u>		
Number of stores per zip code (per square mile)	4.700	1.769
	[11.748]	[6.029]
Population per store (÷ 1,000)	5.192	6.753
	[4.651]	[6.077]
Grocery selling area (square feet in thousands)	21.202	34.029
	[16.413]	[21.676]
Yearly sales volume (in thousands)	$6.452	$11.659
	[8.462]	[10.423]
Market share (share of yearly sales volume)	0.221	0.328
	[0.226]	[0.225]
Number of observations	19836	2181

Note: Standard deviations are in brackets. Means are weighted by the total zip code population. The unit of observation is a postal zip code. The BLS does not survey Montana, North Dakota, and Wyoming, therefore these states are omitted from the above table. In addition, I do not have cost and quality data for stores in Arkansas, Delaware, Kansas, and Rhode Island. The number of observations in the BLS sample is the number of unique outlets. There are multiple outlets in a zip code.

Source: Author's calculations using the 1990 Census STF3B, Bureau of Labor Statistics survey data, and data obtained from Spectra Marketing, Inc.

Appendix Table 2. FE estimates of the unrestricted effect of race and ethnic neighborhood composition on the poor price differential

Group status definition:	(1)	(2)
Poor	-0.086	-0.082
	(0.031)	(0.030)
Predominately black	0.016	0.019
	(0.017)	(0.017)
Poor, predominately black neighborhoods	0.078	0.093
	(0.023)	(0.039)
Predominately Hispanic	0.100	0.161
	(0.041)	(0.037)
Poor, predominately Hispanic neighborhoods	-0.176	-0.233
	(0.055)	(0.055)
Hispanic interacted with:		
Chicken		-0.102
		(0.053)
Eggs		-0.126
		(0.075)
Navel oranges		-0.099
		(0.081)
Lettuce		-0.228
		(0.054)
Hispanic*Poor interacted with:		
Chicken		0.162
		(0.077)
Eggs		0.200
		(0.101)
Navel oranges		-0.434
		(0.180)
Lettuce		0.031
		(0.110)
F-test of Hispanic*item interactions:		4.440
		[.002]
F-test of Hispanic*item*poor interactions:		3.800
		[.005]
Adjusted R^2	0.968	0.975

Note: The dependent variable is the logarithm of the unit price plus tax (price per ounce). Poor is defined as neighborhoods with greater than 20 percent of the residents in poverty and predominately black and Hispanic are defined as neighborhoods located in counties where the respective index of isolation exceeds 0.3. Each regression includes an intercept and item fixed-effects. The model i n column (2) also includes product size, a dummy variable indicating sale prices, and month dummies. The number of observations is 10,170. Standard errors (robust to correlation of residuals within stores) are in parentheses. P-values are in brackets. Prices are weighted by the base-period quantity weight

Source: Author's calculations using the Bureau of Labor Statistics price level data and 1990 Census STF 3B.

Appendix Table 3: Coefficients of heterogeneous model presented in Table4, column (18)

Variable	Coefficient (1)	Standard error (2)	Variable	Coefficient (3)	Standard error (4)
Poor neighborhoods	-0.077	0.040	<u>Discretionary cost variables</u>:		
Predominately black neighborhoods	-0.007	0.026	Proportion utilizing circulars	0.017	0.031
Predominately Hispanic neighborhoods	0.060	0.040	Proportion using in-store demonstrations	0.047	0.025
Poor, predominately black neighborhoods	0.141	0.052	Proportion doubling coupons (÷ 100)	0.006	0.021
Poor, predominately Hispanic neighborhoods	-0.180	0.055	Proportion with frequent shopper program	-0.025	0.020
Dummy variable for milk	0.024	0.135	Proportion using in-store coupons	0.039	0.021
Dummy variable for eggs	2.670	0.027	Dummy if missing circular variable	-0.109	0.051
Dummy variable for oranges	-0.309	0.029			
Dummy variable for lettuce	-0.017	0.043	<u>Market structure variables</u>:		
Dummy variable for 2/1/1998	-0.019	0.006	Number of stores per zip code (per square mile)	0.001	0.005
Dummy variable for 3/1/1998	-0.017	0.006	Population per store (÷ 10,000)	0.000	0.000
Dummy variable for 4/1/1998	0.002	0.006	Grocery selling area (square feet in thousands ÷ 10,000)	0.000	0.000
Dummy variable for 5/1/1998	-0.003	0.007	Market share (share of yearly sales volume)	0.048	0.032
Dummy variable for 6/1/1998	-0.015	0.008	Dummy if missing market share variable	0.170	0.076
Dummy variable for 7/1/1998	-0.016	0.008			
Dummy variable for 8/1/1998	0.034	0.008	<u>Search variables</u>:		
Dummy variable for 9/1/1998	0.043	0.008	Proportion of households without a vehicle	0.049	0.169
Dummy variable for 10/1/1998	0.045	0.008	Number of stores in neighborhood (per square mile)*Poverty rate	-0.012	0.020
Dummy variable for 11/1/1998	0.042	0.008	Proportion of population obtaining high school diploma including GED	0.133	0.261
Dummy variable for 12/1/1998	0.038	0.008	Proportion of population completing some college, n degree	-0.439	0.215
Item on sale	-0.323	0.019	Proportion of population with associate, bachelor's, c graduate/professional degree	0.319	0.149
Product size	-0.010	0.001			
			<u>Quality variables</u>:		
<u>Neighborhood demographic variables</u>:			Proportion with from-scratch bakery	0.018	0.025
Proportion of unoccupied housing units	0.447	0.193	Proportion with delicatessen	-0.012	0.026
Population density (per square mile, per zip code ÷ 10,000)	0.004	0.020	Proportion with butcher department	0.000	0.018
Proportion located in central city	0.000	0.000	Proportion with seafood department	0.008	0.024
<u>Crime variables</u>:			Proportion with pharmacy	-0.025	0.024
Total property crime per capita	0.049	0.036	Proportion with full-service bank	0.083	0.047
Dummy if crime variable missing	-0.002	0.016	Proportion offering check cashing services	0.074	0.022
<u>Cost variables</u>:			Proportion with automatic teller machine	0.033	0.024
Number of checkouts	-0.002	0.003	Proportion with warehouse aisles	0.023	0.031
Number of full-time employees (÷ 100)	0.000	0.001	Dummy if missing full-service bank variable	-0.018	0.032
Number of part-time employees (÷ 100)	0.000	0.000			
Proportion with scanning equipment	-0.024	0.034	Intercept	-2.597	0.171
Chain	0.014	0.019			

Note: Sample size is 10,170. The regression includes local-area fixed effects. The omitted item is chicken and the omitted area is the New York City. Prices are weighted by the base-period quantity weight (see the BLS Handbook of Methods, chapter 17. Standard errors (robust to the correlation of residuals within stores) are in parentheses. Model degrees of freedom total 146.

Source: Author's calculations using the 1990 Census STF3B, Spectra, Inc. data on store characteristics, and Bureau of Labor Statistics price level data.